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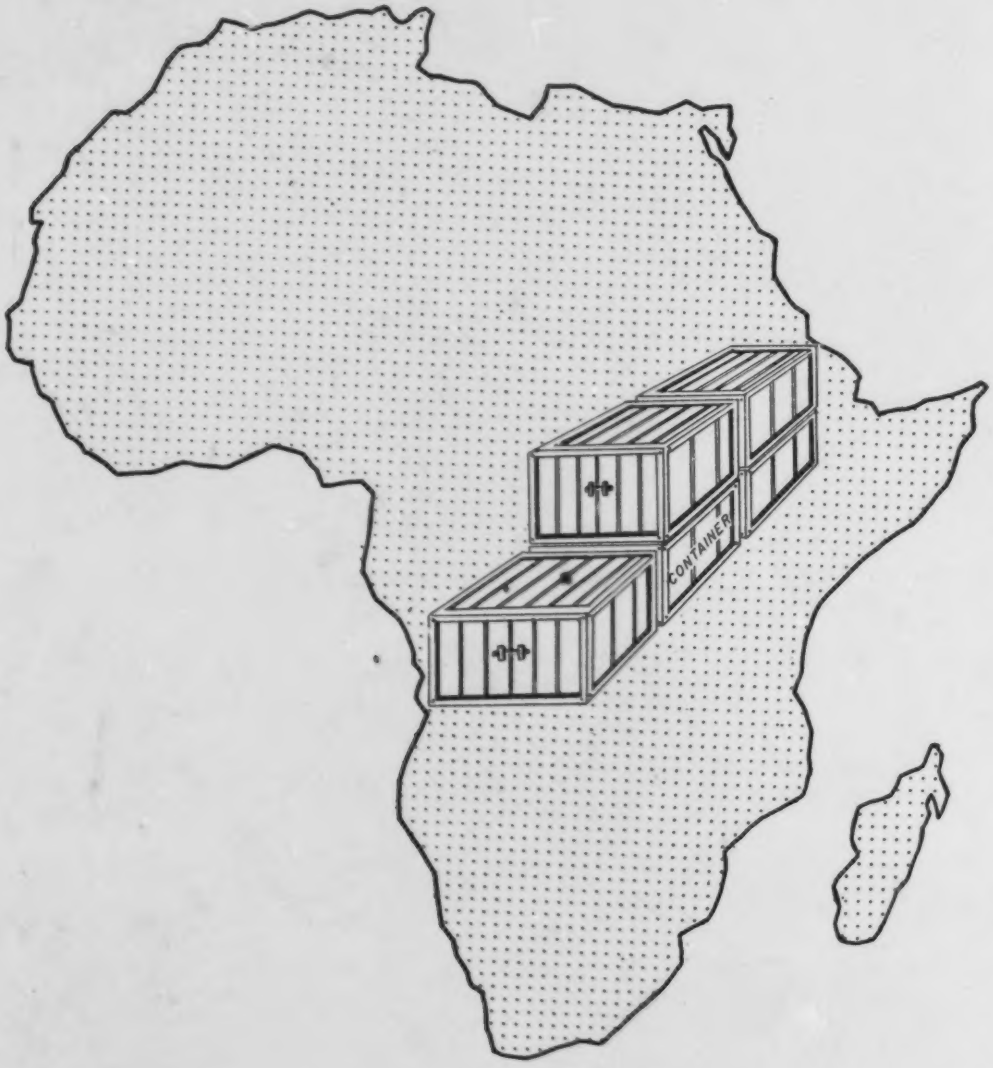

LG/NAIROBI

STUDY ON THE FEASIBILITY OF ESTABLISHING CONTAINER REPAIR AND MAINTENANCE FACILITIES IN AFRICA

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A. GLOSSARY OF TERMS

(i) "Container": An article of transport equipment, including lift van, movable tank or other similar structure, which is fully or partially enclosed to constitute a compartment intended for containing goods, of a permanent character and accordingly strong enough to be suitable for repeated use, specially designed to facilitate the carrying of goods by one or more modes of transport, without intermediate reloading, designed for ready handling, particularly when being transferred from one mode of transport to another, designed to be easy to fill and to empty and includes equipment or accessories usually carried with it. The term container excludes vehicles, accessories or spare parts of vehicles or packaging.

(ii) "Chassis": A vehicle built specially for the purpose of transporting a container, so that when the chassis and container are assembled, the unit produced serves the same function as a road trailer. Can either be straightframe, gooseneck or "couplable" (thus 20 foot frames which slide together to form one 40 foot chassis), or "combination" (one chassis which hauls 20 foot or 40

"EIR": Equipment Interchange Receipt and Safety Inspection Report. A document executed at time of delivery of a piece of equipment to or from one carrier, depot, or agent to another, containing a full inspection report of damage and discrepancies, if any, and to be signed by both parties.

(iv) M.P.L.: Maximum Payload - maximum allowable weight of payload (maximum gross weight less tare weight). Maximum payload is sometimes referred to as the net weight

(v) M.G.W.: Maximum allowable weight of a container including tare weight and maximum payload.

(vi) ISO: International Standard Organization.

(vii) TEU: Twenty Foot Equivalent Unit: refers to ISO standard 668 series ± freight containers - 20' x 8' x 8'06" (or 8'). TEU is generally accepted as a unit measure for containers as well as vessel carrying capacity and port productivity (e.g. + one 20' x 8' x 8'06" = 1 TEU; and one 40' x 8' x 8'06" = 2 TEU)

(ix) IICL: Institute of International Container Lessors; L.T.D. based in New York

B. BACKGROUND AND METHODOLOGY

Over 1,500,000 containers now move through African ports annually. However, while many of the containers still remain within the ports' boundaries where they are unstuffed, an increasing number of containers are finding their way into the interior of the continent. The rapid spread of containerization is largely due to its semi-bulk nature, faster overall transit times, and enhanced cargo protection. As bulk and semi-bulk cargoes present only one type of cargo unit to a port, for example, their handling is easily mechanized.

In some countries of the region, governments have pursued import liberalization policies in an effort to stimulate their national economies. While these policies have been largely successful, they have also created a healthy demand for goods manufactured outside the region, which, in turn, has brought about large inflows of such goods in containers. However, for many African countries the trade pattern is to import manufactured goods and export agricultural produce and raw materials. In this situation, there is likely to be an imbalance in trade - that is, the number of loaded containers entering a country compared to those leaving with export cargoes. This is important, because container service costs are more sensitive to imbalanced trade than those of break-bulk services, for the simple reason that empty journeys for containers are costly.

Another cause of container imbalance in the region is the low container export usage in Africa. Many containers leave African ports empty for reporting and repairs elsewhere. The probable cost of loss or damage to the container invariably adds to the cost of imports or exports of a country. The level of investment required to establish a container repair facility is difficult to quantify as there are so many variables involved but experience of other developing regions' investment in manpower, and their largest financial requirements involve land, buildings, and equipment. While the skills and investment required to enter a container repair business at a minimum level may be small, the repair facility can be expensive involving the high cost of buildings and equipment such as cranes, fork-lift trucks, service fans, short-blasting and spray-painting.

When looking at the tremendous impact a systematic containerization in Africa will have on transportation of imports and exports of the region, there is no doubt that demand for container repair and maintenance services is going to increase. Governments, port authorities, carriers, and major exporters in Africa must, therefore, give serious consideration to container maintenance and repair in order to avoid artificial shortage of containers and the higher freight costs of back-hauling damaged empty containers, thus creating a bottleneck on the movement of the region's exports.

The long-term objective of the study is to systematically develop an African container repair and maintenance industry. The immediate objective is to carry out a pre-feasibility study on establishment of container maintenance and repair centres in the region.

The study was organised in the following manner: (i) at the beginning, a thorough study was made of the relevant documents and reports on the subject of containers and their maintenance and repair available at ECA, especially the ECLAC publication entitled "Establishing Container Repair and Maintenance Enterprises in Latin America and the Caribbean", and other similar maritime publications. Thereafter study visits were undertaken to a cross section of member States for collection of data and additional information for the study, making first hand observations on container maintenance and repair activities, and holding discussions with officials and specialists in the field on their suggestions and for any inputs for improving results of the study. Also, a few shipowners plying to the region were interviewed on the question of the container and its maintenance and repair. Visists were made to other organisations in the region like the Ministerial Conference for West and Central African States on Maritime Affairs (MINCONMAR), the Inter-Governmental Standing Committee on Shipping (ISCOS) and the North African Port Management Association. The experience of the Economic Commission for Europe (ECE) and the United Nations Conference on Trade and Development was also taken into account through discussions with their experts.

The port of Antwerp which has a container repair subsidiary was visited. Also visited was its container maintenance and repair workshop.

C. SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The container originated as a method of road haulage by United States hauliers, Malcolm Maclean in the 1950's. The whole spectrum of the container seaborne trade now acknowledges the importance of containerization and the role played by the container in changing the face of the whole transport chain of the dry freight cargoes.

The container has now become the method of transporting commodities throughout the world. It has been adapted to all types of cargo. For reasons of economies of scale on large TEU vessels, quick turn-round times, cargo security and protection, the container has grown from strength to strength and has worked well to the disappointment of its critics. So far there is no really competitive system to containerization in the movement of dry freight cargo.

Participation of developing countries in general and this region in particular has remained low. However, considering the low cargo conversion and low export usage, significant growth of containerization is expected in this region for the next few years. In all forecasts, this region, and other developing countries, constitute the largest contribution to anticipated growth of containerization for the next few years. Whereas in the developed countries, the rate of containerization has almost reached a maximum growth level.

There are 4.8 million containers in TEU in the world and this figure is expected to increase to five million TEU by the end of 1987. Out of these containers, 3.6 million TEU are standard units and the rest special units. 84.1 per cent are steel cladded and 14 per cent aluminium and 1.9 per cent GRP. Therefore, maintenance and repairs carried out are mainly of steel equipment. The situation is expected to be so for many years to come.

Ownership of both the containership and the container equipment is in the hands of the traditionally strong maritime nations of the world. The developing countries' role is still very small. Regarding the container itself, the carriers and lessors in the developed countries control more than 97 per cent of the world container inventory leaving only 3 per cent shared between all the "other" owners e.g. shippers.

Container trade to and from the region can be described as medium/low as shown in Table 13 and 18. The region makes up only 2.5 per cent of the total world throughput of container traffic.

The port throughput for individual ports has generally been increasing since the 1970's. Four ports have now reached the 100,000 TEU and above. More are expected to reach this mark within the next few years. The disturbing features of the container trade of the region is that it is highly imbalanced and fewer containers are used in the export leg of the trade route. This imbalance has cost the region a lot of money and foreign currency. For example, Nigeria loses an estimated US$50.0 million, Cote d'Ivoire US$13.6 million and Kenya US$3.3 million per year through passed-on cost of transporting empty containers. The figure per year for the whole region is certainly higher. This phenomenon also has adverse effects on the demand for container maintenance and repair as container owners are unlikely to repair in areas of low export usage.

It is, therefore, recommended that a through investigation into the causes of the low export usage of containers be undertaken for the region and solutions found for the region to take necessary remedial measures. It is also suggested that the region should pay more attention to the ever changing measurements of the containers as passed from time to time by ISO. Failure to do will render the existing investments in port, rail and road facilities obsolete.

The region has certainly made headway in providing facilities for containerization like ports, rails and road trucks, inland container terminals or dry ports, etc. Very little, however, has been done to provide facilities to maintain and repair the container equipment itself. Given that a world bill of over US$500 million has now been confirmed and that this region is among those areas of high risk of container loss and damage, it is time that the region paid special attention to the container equipment itself and its maintenance and repair.

Containers are damaged during the process of transportation; during the sea voyage, in port handling and stacking yards and throughout its transiting journey into the hinterland. 95 per cent of the container damage in this region occurs in the port areas and in the hinterland. However, according to the field findings, a larger proportion of blame is on the hinterland portion of the trade routes.

The most common types of damage are indentations to the container panels, damage to the bottom side rails, cross member, side posts, roof bow, top rails and doors. Apart from handling, the behaviour of drivers of cranes, forklifts, rail and road trucks was identified as the cause of damage due to accidents. Also, poor roads, narrow bridges, low overhead bridges, trucks, etc. contribute to a high rate of damage due to accidents. Few damages to containers happen at sea, only 5 per cent. This is the main cause for collapsing types of container damage.

The region, has very few firms accepting containers for maintenance and repair. However, these facilities have been said, by container owners, to produce poor and sub-standard work, so much so that equipment owners have had to do the repair again when the units reach European ports. Most maintenance and repair work is done abroad for this reason and also due to low cargo conversion, poor export usage, lack of proper facilities and poor supervision attributed to lack of expertise in this field, multiplicity of middlemen and purely on economic repair cost consideration of the container owners concerned.

Demand for maintenance and repair exists in the region. This is reflected by the market oriented activities especially in the high export usage areas like Abidjan, Mombasa, douala and Djibouti and also areas of special consideration like Dakar, Matadi, and Maputo or Beira. In these areas, it is a considered expert view that it would be feasible to establish container maintenance and repair facilities.

The region should, therefore, take deliberate action to increase the awareness of all those involved in the process of handling the container to the need to focus their attention on the container itself, its wellbeing, maintenance and repair.

It is also necessary for the region to identify key personnel in the whole chain of container transportation and bring them together under a seminar or workshop at which experts on container maintenance and repair could present papers in order to evaluate the degree of the problem of container damage and how it affects various modes of transport in the region. Certainly something must be done soon to correct the behaviour of drivers of cranes, forklifts, rail and road trucks to reduce damage due to accidents.

There is also a need, at regional level, to look into the causes of the low cargo conversions and low export usage by way of a thorough study, and recommend possible solutions for the region as this aspect of the trade has significant effects on the kind of maintenance and repair facilities that would be established in the region.

Based on the current market activities going on in the region, it would appear that the region is in serious need of the maintenance and repair facilities. It is an expert view that establishment of these facilities would now be feasible in the region. The following locations have been identified:

(a) Location of immediate need:

(i) Abidjan
(ii) Mombasa
(iii) Douala
(iv) Djibouti

(b) Locations of future need, and subject to review within the next 2-3 years:

(i) Dakar
(ii) Matadi
(iii) Maputo or Beira

Furthermore, the port authorities in these areas indicated above, should be encouraged and assisted in every way possible to establish maintenance and epair facilities to cater for current needs of the region.

The whole issue of container damage and maintenance should be reviewed during the next 2-3 years in order to keep the region informed of what is taking place with regard to this important transport equipment.

CHAPTER I

INTROCUCTION

1.1 Cargo unitization

Throughout the generations of transport development, there has been a constant search by man, as owner of transport equipment and user, into better ways of accomplishing his tasks. The packing and transporting of goods by sea has received much attention in recent years (annex 1).

The study of the movement of materials in industrial plants (annex 1), warehouses, on loading and discharging platforms and at ports and other terminals has led to the development of the unit-load principle. Unitization is the combining of small cargo components or units of a load into a single, homogeneous and larger unit.

In commerical cargo handling, (annex 1) the unit to be transported is a package of commodity in question. This commodity may be transported as a single piece, packed or bare, e.g. a piece of machinery, a bag of coffee, carton of tea etc. All these units need considerable, usually manual, handling at each point of transport interchange. To illustrate this aspect of transportation more clearly, a study undertaken on behalf of a large multinational organisation revealed that a particular shipment between the US - mid-west and West Germany, an average consignment was handled no fewer than 33 times during the course of its transshipment. The more the number of handlings, the higher the cost added to total transport of that item. Larger units reduce this cost and promise lower delivery costs per unit of cargo handled. Also, these types of cargo commonly known as breakbulk cargoes do not lend themselves well to multimodal transport. Various ways of enlarging the individual package by the combination of small units into large and homogeneous ones have been devised. Such larger or unitised packages lend themselves to a higher degree of mechanised handling, thereby reducing the manpower needed while at the same time increasing the speed with which a given tonnage can be moved. Hence, the larger the unit the greater the speed of handling per ton.

Unitized goods can be very simple in form e.g strapping or bonding together two or more packages or boxes or crates, as the case may be. It may also involve well tested systems like palletization, pre-slinging and containerization. The most dominant of them is containerization. This is confirmed by the effect it has had on ports, cargo storage areas, shoreside cargo cranes, cargohandling equipment, ships, rail and road trucks and transport documentation and procedures to facilitate their smooth movement (annex 1).

1.2 Containerisation

The container has had the greatest impact over virtually all forms of land, sea and air transport equipment. The container has transformed the seaborne freighting of dry cargo into a fundamentally inter-modal or through transport concept for the past 23 years for developed market regions and 10 years for the African region.

The origins (annex 1) of the container concept lie in the transport operators' desire to minimise in-transport cargo handling and to provide a door-to-door service on an international basis using whichever land mode is most appropriate.

The major attraction of containers to the shipping lines lay in the opportunity presented to them to free themselves of the constraints placed by ports through their slow handling rates and the attendant high labour cost and port charges. In 1960, it was estimated (annex 1) that for a conventional liner vessel, costs accounted for 60 per cent of total shipping costs from port-gate to port-gate. When this was coupled to the time which the ship spent in port, the port sector of the trip accounted for 80 per cent of the total costs associated with long distance shipping movements. Also, whereas a general cargo ship carrying 10,000 dwt. of cargo could remain in port at least five days discharging all cargo, a fully cellular container ship carrying similar cargo volume could work all the cargo in less than a day (annex 1).

On a typical trade route between Europe and Australia, an owner employing modern general cargo "break-bulk" vessels, could normally only expect 2.2 round voyages per annum out of each ship (annex 1). Of this time, some 65 per cent was spent in the various ports at each end of the trade route. In the ports concerned, depending on the commodities involved and the distribution of commodities between the different holds within the ship, stevedores might handle an average of 350 to 400 tons of break-bulk cargo per day, assuming that the port time was free from industrial action. The same shipowner who traditionally achieved 2.2 round voyages from his Australian trade vessel, was now achieving 5.5 round voyages per annum from the container ship with nearly three times more cargo capacity.

Of course, the shipowners were not alone in suffering from the poor handling methods of handling their ships, to which the traditional queues of road vehicles and railway rolling stock waiting to be unlodaded at port gates gave witness. For days on end, these expensive items of capital hardware stood unproductively idle. Similar problems were being encountered at the various shippers and consignees premises.

Therefore, shipping lines responsible for transport required a system of transport which could accommodate the need for physical distribution taking into consideration the required convenience, speed, safety and low cost (annex 1). The aim is to have manufactured goods to final destination using a common carrying unit and to eliminate costly and complicated transshipment operations at sea ports.

After the second world war, ship owners' answer to the foregoing problem was to lift the hand carrying vessel and offload it at the port of destination (annex 1). A subsequent refinement came about when the question of "dead space" occupied by the trailer's running gear (wheels etc.) was raised (Annex 1). Then came the idea of detachable bogies which could be left with the tractors at each port's quay side. Eventually, the container as we know it today was designed, built and put into service.

Although the potential for the concept of containerization was recorded as early as 1931, it was not until 1955 that the concept was vigorously pursued

by an American Road Haulage Operator, Malcolm Maclean who over a twenty year period had built up one of the largest road haulage companies in the USA.

In 1955, Maclean sold his land haulage business and purchased Waterman Steamship and its subsidiary, Pan Atlantic steamship. Maclean's initial intention was to carry cargo vans and chassis, as explained above, and carry them on the tanker ships. "Dead Space" and safety problems resulted in only the cargo van being shipped. Hence the "van container" which is still used in 40 ft size by lines like Evergreen. Eventually, the chassis was dropped and the standard multipurpose container was instituted. On 26 April 1956 (Annex 1) a tanker vessel, "Maxton" sailed from New Jersey to the Latin American port of Puerto Rico with a load of 58 van containers stored on deck. After a year of trial, the US Coast Guard and the American Bureau of Shipping agreed to rules prescribing the container and safety standards. In 1957, the first recorded container vessel in history the "Gateway City" commenced operations. The van containers at the time measured 30' x 8' x 8'06" this being the largest size that trailers could carry at that time.

In 1960, Maclean changed the operating name of his steamship company from Pan Atlantic Steamship Co. to Sealand Services. Sealand still exists as one among the top five giant container operating companies in the world (Table 1 (a)). By 1964, the Alaskan trade between Seattle and Anchorage was containerized. In 1966 the intermodal container services commenced with Sealand Service between North Atlantic ports and their European counterparts.

Since then the expansion of containerization increased at a high growth rate. With six to seven years after Sealand commenced its North Atlantic container service, almost all the major trade routes connecting North America, Europe, Japan and Australia had been containerized (Table (b)).

Table 1(a)

Container shipping's top ten

Position	1980 Name	1980 000 TEU	1985 Name	1985 000 TEU	1987 Name	1987 000 TEU
1	Sealand	60	Evergreen	86	Evergreen	103
2	Hapaglloyd	42	US lines	79	US lines	93
3	Maersk	35	Sealand	62	Sealand	74
4	OCL	31	Maersk	59	Maersk	63
5	CGM	30	Hapaglloyd	45	OCL	49
6	Evergreen	30	OCL	45	Hapaglloyd	48
7	ZIM	26	Nedlloyd	39	MOL	45
8	APL	26	NYK	38	OCL	45
9	NYK	24	MOL	36	COSCO	43
10	MOL	23	ZIM	35	Yangming	42

Source: P. Fenyoe "Container Trade Owners" Container Transportation 21-26 September 1986 Selwyn College Cambridge.

Table 1 (b)

Development of containerization by route

Routes opened up	Year of first service	Initial operator(s)	Vessel size (TEU)
1966-1970			
USEC/Europe	1966	Sealand	1000
USWC/Japan/FE	1967	Matson and NYK	465
	1968	NYK/showa	752
Europe/Australia	1969	AECS	1320-1590
Australia/Japan	1969	ANL	620 (RO RO)
USEC/Japan	1970	USL	1210
1971-1972			
Europe - Japan	1971	Trio	1842-2452
1973-1983			
Europe/Med-Middle East	1976	Sealand	833-1089
Europe/Caribbean	1976	Carol	1160
Europe/Med-South Africa	1977	SAECS	1309-2450
Europe/West Africa	1977	EAC	1000
North America/Middle East	1978	UASC	800
Japan/FE-Middle East	1978	NYK.MOL	676
Australia/Middle East	1978	Gulf	432
Europe/E.C. South America	1979	Hapaglloyd	-
Japan/FE-Indonesia	1980	JICS	424
Europe/Med-East Africa	1981	BEACON	1110
Japan/FE-W.C. South Africa	1981	Safari Service	1266-1770
Europe/India	1981	India SS	-
1984 -			
Europe/W.C. South America	1984	Earosal	1988-2219
Round the world	1984	Evergreen	2728
Round the world	1984	US lines	4482

Source: R. Fenyoe "Container Trade Overview" Container Transportation 21-26 September 1986, Selwyn College Cambridge.

Table I(b) shows that the first phase between 1966 and 1971 was characterised by the containerization of the major trade routes and by the gradual introduction of high capacity vessels.

The second phase, 1971-1972 was characterized by larger, faster vessels designed to cope with the increased throughput of the trade as containerization increased and to open up the Europe/Far East trade route.

In the third phase, 1973-1983, many more routes were opened up including those to developing market regions like Africa.

The fourth phase started in 1984, with large round the world services. This phase is characterised by very large fully cellular container vessels.

The shipowners, who previously were concerned only with ship and cargo on a port to port basis were now faced with new problems: high investments in cellular container vessels (Table 2) or ro-ro (Table 3); high investment in containers; maximum utilisation of containers (minimum dwelling time at each end of the trade); allocation and movement of containers; securing containers on deck; berthing arrangements at terminals; new discharging and loading techniques of containers; delivery of containers by shippers; storage of empty containers, inspection; maintenance and repair of containers.

Of course, in the wake of such a fundamental change in the system, many other aspects of the transport business had to change, for no aspect of the industry remained untouched. Terminals made large open paved spaces to store the containers, whilst large overhead container gantries replaced the army of five ton cranes which characterized the traditional port scene. The container necessitated the design and breeding of new road and rail equipment, heavier tractor units and long wheelbased platform wagons to handle the weighty containers. Containers, whether owned or leased, had to be built and controlled in large numbers. Documentation and other systems had to be redesigned to take into account not only the new technology, but also the speed at which transport events were now happening. All this entailed massive investment (Table 4) to contain and service the inflow of container vessels and container units.

Table 2

Recent new building prices for cellular containerships

Date of announcement and source	Description of vessel/owner	No. ordered	New building price per unit	Delivery date(s)
First half 1979 Fairplay	2492 TEU/49,360 DWT American President Lines	2	$US 82.5 million US yard	1982
First half 1981 Fairplay	1800 TEU United Arab Shipping Co.	9	$US 40.0 million Korean yard	1983
Second half 1981 Fairplay	1800 TEU Nedlloyd	2	$US 41.0 million Korean yard	1983-1984
Second half 1981 Fairplay	1400 TEU Nedlloyd	2	$US 41.0 million Korean yard	1983-1984
Second half 1980 Fairplay	1466 TEU 26,700 DWT Nedlloyd lines Rotterdam	1	$US 40.1 million Japanese yard	1982
First half 1982 Fairplay	1910 TEU Hapagloyd	2	$US 40.0 million Korean yard	1984
First half 1982 Fairplay	1954 TEU Evergreen	6	$US 30.0 million Taiwan yard	1983-1984
Second half 1983	4218 TEU 58,000DWT United States lines	12	$US 47.5 million	1984-1985
Second half 1984	2500 TEU Lykes lines	2	$US 37.5 million Japanese yard	1985
Second half 1984	2970 TEU	2	$US 27.2 million Korean yard	1986
Second half 1984	3300 TEU	1	$US 42.0 million Danish yard	1986
Second half 1984	854 TEU	1	$US 17.5 million W. Germany yard	1985

Source: G. De Monie "Alternative Containership and Terminal Systems: Layout and Operational Features of pure and combined Terminals "UNCTAD/SHIP/612, pg 56.

Table 3

New building prices for pure ro-ro ships designed to service deep sea-routes

Date of announcement and source	Description of vessel/owner	No. ordered	New building per unit	Delivery date(s)
First half 1979 Fairplay	8,500 dwt ro-ro Delta Navigation	2	$US 15 million	1981
First half 1979 Fairplay	6,500 dwt (443 TEU) Ro-Ro freight-ship Bore Steamship Co. Finland	2	$US 19.0 million	Sep./Nov.80
Second half 1979 Fairplay	9,000 DWT 155 trailers 125 cars Caribbean Transport Inc.	1	$US 19.5 million	1980
Second half 1979	23,500 DWT 11524 TEU Waterman Steamship Corp.	1	$US 70.0 million	1981

Second half 1979 Fairplay	22,000 DWT Soviet Union	2	$US 50.0 million	1981
First half 1980 Fairplay	3,500 DWT, Ro-Ro "Merc-multiflax" Mercandia	6	$US 12.0 million	1982.83
First half 1980 Fairplay	20,000 DWT Ro-Ro 1040 TEU Johansson Group	1	$US 44.0 million	1981
First half 1982 Fairplay	2,000 TEU ships Barber Blue Sea lines	3	$US 67.0 million	1983/87
Second half 1982 Fairplay	464 TEU/Ro-Ro Hipermodal Trans- ports Navigacao Brazil	2	$US 35.0 million	end 1983
Second half 1984 Fairplay	433 TEU, Ro-Ro Mercandia		$US 20.0 million	1985/86

Source: G. De Monie "Alternative Containership and Terminal Systems; Layout and Operational Features of Pure and Combined Terminals" UNCTAD/SHIP/612, pg 65.

Table 4

Regional distribution of IBRD1/ and IDA2/ lending operations for ports and waterways projects as at 30 June 1980

Region	Number of lending operations	Amount of loans/credit ($US million)
Eastern Africa	15	225
Western Africa	12	132
East Asia and Pacific	16	342
South Asia	18	210
Europe, Middle East and North Africa	25	984
Latin America and Caribbean	20	210
Total	106	2,133

Source: Containerization and the Developing World Containerization International Seminar held in London 6-7 October 1980 Pg. 29.

1/ The International Bank for Reconstrucion and Development (IBRD)

2/ The International Development Association (IDA)

1.3 Evolution of the containership

In the initial stages of containerization, conventional vessels were converted to allow container carrying capacity. The changes of the conventional vessel to accommodate containers have been most notable in the SD.14 (15,000 dwt), the staff standard freighter (24,000 dwt) and the freedom classship. These vessels are often converted by fitting them with new and strengthened decks, new hatch cover designs and hold configuration. Also fitted are flexible and fast deck cranes. When converted they can allow transportations of 300 to 400 TEU. For many independent shipowners, this type of vessel represents an economic means to capture part of the container trade on developing country routes, without being forced to sacrifice the basic cargoes of raw materials, semi-manufactured goods and industrial project cargoes.

Since late 1970, fully cellular vessels were ordered (Table 2 and 3) and introduced in the market to cope with the incressed port container traffic (Table 19). Since then, the fully cellular container ship has undergone several changes (Table 5). Like in many spectra of maritime activities, there is an increasing number of hybrid containerships in today's merchant fleet. A range of specialist types are linked together by those vessels which "bridge" the gap between them (Table 6). The world fleet of container carrying vessels for the years 1970-85 by new builds, size band, vessel type and TEU deployed is given in Table 7. The table shows an accelaration in the world container fleet. Table 8, which gives the position as end of 1986, shows a slowdown in the rapid acceleration. However, the current container fleet continues to be dominated by fully cellular/converted cellular tonnage which accounts for 1,329,699 TEU (51.7 per cent) of the 2,571,301 TEU in service. On a weighted short basis, (Table 9), its importance is even stronger, amounting to over 65 per cent of all tonnage in operation.

Table 5

Main characteristics of five different generations of containerships

Type	Name	Year built	DWT	ART	Overall length	Breadth	Draught	Capacity TEU	Speed knots
First generation	Weser express 1/	1968	10,800	14,500	171 m	21.5m	7.85 m	700	20.6
Second generation	Encounter by 2/	1968	29,600	27,000	227 m	30.5 m	10.69 m	1500	21.5
Third generation	Liverpool Bay 2/	1972	48,540	58,890	290 m	32.3 m	13.00 m	3000	26.0
Fourth generation	United States line	1984-85	58,000		289.5 m	32.3 m	11.60 m	4218	18.0
Fifth generation	Astilleros Esp and design	1983			368.0 m	47.0 m	12.00 m	5800	16.5

Source: Lloyds Register of Ships
Containerization International/Fair Play

1/ Lengthened in 1973
2/ Re-engined

Table 6

Spectrum of ship types

Cargoes	Ship types	"Linking" types
Gases	Airships	
		Liquidified gas carriers
Bulk liquids	Parcel tankers	
	Products tankers	
	Crude oil carriers	
		Oil/bulk ore (OBO)
		Oil/oil carriers
Bulk solids	Ore carriers	
	Bulk carriers	
	Handy bulkers	
		Liberty replacements
General cargo	Twin deckers	
	Reefers	
		Semi containership
Unit loads	Containerships	
		TEU Ro-Ro
Vehicles	Ro/Ro	
		Vehicle ferries
Passengers	Passenger vessels	

Source: D.F. McBride "Ship types and container handling equipment" Container Transport 21-26 September 1986, Selwyn College Cambridge. Pg.17.

Table 7(a)

Newbuilds and the implied incremental growth of the World Container Carrying Fleet

Change 1970-1985, and newbuilds, by size band and TEU deployed

	1970-1985		1975-1980		1980-1985		Newbuilds	
	000TEU	%	000TEU	%	000TEU	%	000TEU	%
100-799 TEU	177	39	414	50	266	33	77	21
800-1600 TEU	129	29	226	26	239	29	77	21
1601+ TEU	143	32	211	24	307	38	214	58
Total	450	100	880	100	812	100	368	100

Table 7(b)

Newbuilds and the implied incremental growth of the World Container Carrying Fleet

Change 1970-1985, and newbuilds, by Vessel Type and TEU deployed

	1970-1975		1975-1980		1980-1985		Newbuilds	
	000TEU	%	000TEU	%	000TEU	%	000TEU	%
FC/CC	259	58	342	39	403	50	244	66
RR/RC	46	10	170	19	104	13	31	8
SC	91	20	265	30	164	20	53	14
Other	54	12	103	12	141	17	41	11
Total	450	100	880	100	812	100	368	100

Source: R. Fonyoe "Container Trade Overview" Container Transportation 21-26 September 1986. Selwyn College Cambridge.

Table 8

Summary of world containership fleet and order book
by size and type at end of third quarter 1986

	Under 500 TEU	500-999	1000-1499	1500-1999	2000-2499	2500+	Total TEU
FULLY CELLULAR							
(i) Present world slots	104,515	147,051	199,118	248,035	176,176	319,994	1,195,593
Number of ships	372	204	162	144	78	107	1,067
(ii) Slots on order	2,132	8,468	20,842	16,940	-	104,174	152,556
Number of ships	5	13	16	10	-	35	79
CONVERTED TO CELLULAR							
Present world slots	11,487	43,813	67,850	4,998	6,048	-	134,196
Number of ships	36	62	58	3	3	-	172
PURE RORO AND RORO/ CONTAINER							
(i) Present world slots	108,514	77,373	88,497	28,479	23,330	8,250	334,443
Number of ships	421	121	71	16	2	3	613
(ii) Slots on order	8,698	13,901	-	-	-	-	22,599
Number of ships	24	21	-	-	-	-	45
SEMI-CONTAINER/ BREAKBULK							
(i) Present world slots	409,360	181,452	15,935	-	-	-	606,747
Number of ships	1,639	283	14	-	-	-	1,936
(ii) Slots on order	3,926	14,979	-	-	-	-	18,905
Number of ships	13	22	-	-	-	-	35
BULK/CONTAINER							
(i) Present world slots	21,101	75,992	94,666	81,874	6,458	-	280,094
Number of ships	65	107	76	50	3	-	301
(ii) Slots on order	-	1,000	1,200	-	14,323	-	16,523
Number of ships	-	2	1	-	7	-	10
BARGE CARRIERS							
Present world slots	2,902	11,364	2,947	3,104	-	-	20,317
Number of ships	9	17	2	2	-	-	30
Total							
(i) Present world slots	657,882	537,045	469,043	366,490	212,597	328,244	2,571,301
Number of ships	2,552	794	383	215	95	110	4,149
(ii) Slots on order	14,756	38,348	22,042	16,940	14,323	104,174	210,583
Number of ships	42	58	17	10	7	35	169

Source: Containerization International, January 1987

Table 9

Weighted slots in service and on order as at 7 November 1986

	In service		On order		Total	
	No.	Capacity	No.	Capacity	No.	Capacity
FC/CC	1239	1,329,699	70	152,556	1,318	1,482,255
RC	133	70,244	10	3,713	143	73,957
BR	510	120,393	35	8,825	545	129,218
SC/BB	1,936	303,374	35	9,453	1,971	312,827
BC	301	142,047	10	8,262	311	142,309
BA	30	10,159	-	-	30	10,159
Total	4,149	1,973,916	160	182,809	4,318	2,156,726

Source: Containerization International, January 1987.

1.4 World container fleet by region of beneficial owner

Like in all other aspects of the maritime industry, it is the very traditional maritime countries, the majority of whom are from the developed market region, who own a large portion of the world container fleet (Table 10). In percentage share by group of countries, the developed market economy countries owned 59.4 per cent of the container ships and lighter carriers in 1986. Open registry countries took 14.6 per cent and developing countries 13.0 per cent of which Africa owned only 0.1 per cent of the percentage share at the end of 1986. The African share of 0.1 per cent represented by three ships (Table 11). This ownership of container vessels is certainly related to ownership of container equipment. In terms of container ship slots, Containerization International sums it up

"Slots in service and on order by nationality of beneficial owner, shows clearly a very uneven geographical distribution when it comes to which nations control the fleet" (Annex 1).

Western Europe, USA and the Far East control a greater portion than all other countries put together (Figure I). The developing world controls only 9.3 per cent of the total operational slots representing only 239,130.9 TEU. However, strong growth is scheduled for the developing countries because they display a total order book of 32,475 TEU (Figure 2). This corresponds to 15.4 per cent of the total slots contracted (Annex 1) and will result in their share of the world slots increasing to 10 per cent representing 276,830 TEU in two years' time (Annex 1). The share of Africa is expected also to rise to about 1 per cent. Therefore, it is expected that containers in this region will continue to be carried in foreign owned vessels for many years to come unless a deliberate move is taken to increase participation in this industry.

FIG. 1 – % BRKDOWN OF CONTSHIP.IN SERV.

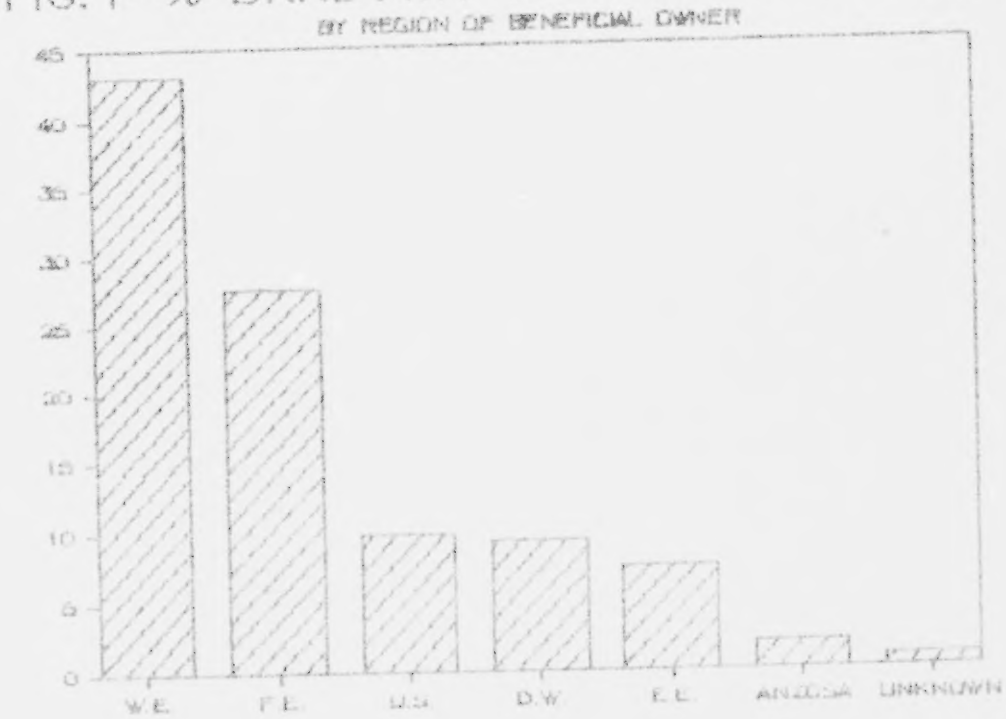


FIG. 2—2. BREAKDOWN OF CONTAINERSHIP

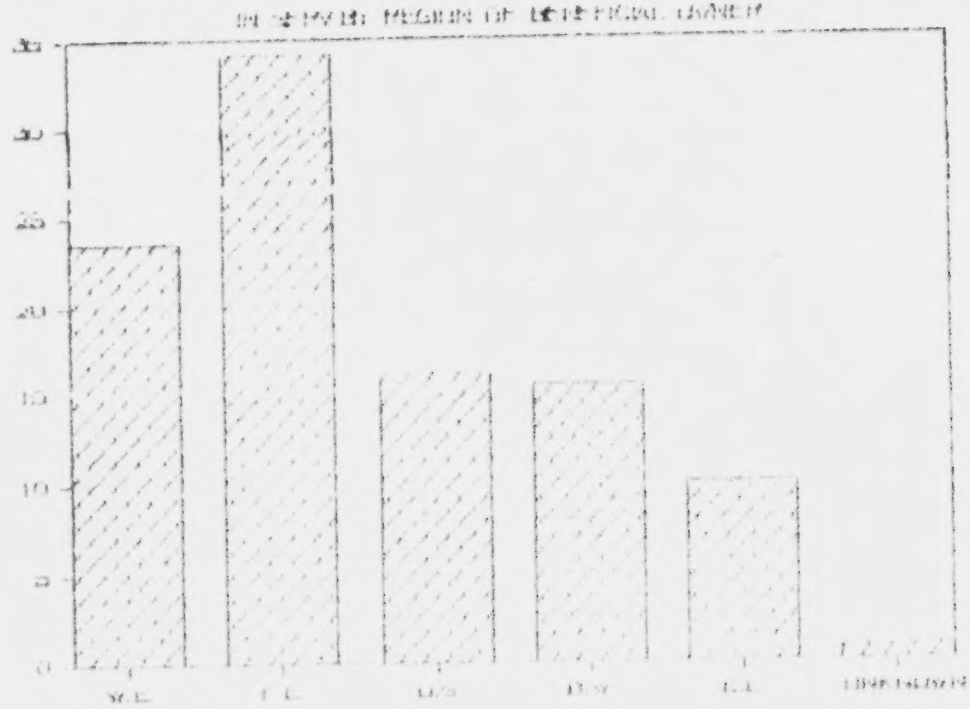


Table 10

Percentage shares of world tonnage by type of vessel and groups of countries (as at 1 July), 1980, 1984, 1985 and 1986 a/ (in terms of dwt)

Country group	Year	Total dwt		Tankers	Ore and bulk carriers b/ including combined carriers	General cargo ships c/	Container Ships and lighter carriers	Other ships
		Million $	% of dwt of world total	Percentage share by vessel type				
World total	1980	682.8	100	49.7	27.2	17.0	1.6	4.5
	1984	674.5	100	42.4	33.0	16.1	2.7	5.8
	1985	664.8	100	39.3	34.9	15.9	3.0	6.9
	1986	639.1	100	37.5	36.0	15.8	3.4	7.3
				Percentage share by groups of countries				
Developed market-economy countries	1980	350.1	51.3	52.5	52.7	43.4	74.3	50.4
	1984	303.4	45.0	48.8	42.5	35.4	66.1	48.3
	1985	282.9	42.5	46.8	38.9	34.4	63.4	46.7
	1986	243.8	38.1	41.7	34.8	30.8	59.4	42.8
Open-registry countries	1980	212.5	31.1	36.2	31.7	20.8	13.5	17.0
	1984	202.2	30.0	34.8	31.9	20.5	11.7	18.8
	1985	203.4	30.6	35.5	32.8	20.3	13.0	23.1
	1986	201.1	31.5	38.2	31.9	20.7	14.6	25.6
Socialist countries of Eastern Europe and Asia	1980	37.8	5.5	2.8	4.2	12.3	2.9	19.2
	1984	55.4	8.2	3.9	6.8	19.9	4.7	17.0
	1985	58.5	8.8	4.4	7.3	20.8	5.5	15.2
	1986	60.6	9.5	4.5	8.2	22.1	6.8	15.3
of which in Eastern Europe	1980	37.8	5.5	2.8	4.2	12.3	2.9	19.2
	1984	40.3	6.0	3.0	4.5	13.7	3.5	15.7
	1985	41.3	6.2	3.4	4.7	13.9	3.3	13.0
	1986	42.1	6.6	3.3	5.3	14.4	3.9	13.8
in Asia	1980	10.9	1.6	0.6	1.6	4.7	0.1	1.3
	1984	15.1	2.2	0.9	2.3	6.2	1.2	1.3
	1985	17.2	2.6	1.0	2.6	6.9	2.2	1.2
	1986	18.5	2.9	1.2	2.9	7.7	2.9	1.5
Developing countries d/	1980	68.4	10.0	7.7	9.2	17.6	7.6	12.0
	1984	107.1	15.9	12.1	17.1	23.7	13.2	15.8
	1985	113.4	17.1	12.9	19.4	24.0	12.1	15.0
	1986	127.0	19.9	15.2	23.5	25.8	13.0	16.2

Country group	Year	Total dwt		Tankers	Ore and bulk carriers b/ including combined carriers	General cargo ships c/	Container ships and lighter carriers	Other ship
of which in Africa	1980	7.1	1.1	1.1	0.1	2.3	-	2.1
	1984	7.8	1.1	1.2	0.2	2.4	-	2.6
	1985	8.0	1.2	1.4	0.4	2.5	0.1	2.3
	1986	7.5	1.2	1.1	0.5	2.7	0.1	2.3
In America	1980	21.8	3.2	2.3	3.3	5.6	0.1	3.7
	1984	22.2	3.3	2.8	2.9	5.8	0.3	3.6
	1985	23.3	3.5	2.8	3.2	6.0	0.5	3.7
	1986	25.9	4.1	3.6	3.7	6.5	0.8	1.0
In Asia	1980	39.1	5.7	4.3	5.7	9.9	2.7	5.7
	1984	74.6	11.1	8.1	13.1	11.5	12.9	9.5
	1985	78.6	11.8	8.5	15.0	14.4	11.5	8.9
	1986	85.1	13.3	9.8	17.6	13.9	11.8	9.7
In Europe d/	1980	1.2	-	-	-	0.1	-	-
	1984	2.1	0.3	-	0.5	0.8	-	-
	1985	3.0	0.5	0.2	0.6	0.9	-	-
	1986	7.9	1.2	0.7	1.6	2.5	0.3	0.1
In Oceania	1980	0.2	-	-	-	0.1	-	-
	1984	0.4	0.1	-	0.1	0.2	-	0.1
	1985	0.4	0.1	-	0.1	0.2	-	0.1
	1986	0.5	0.1	-	0.1	0.2	-	0.1
Other	1980	3.0	0.5	0.2	0.6	0.9	1.6	0.1
Unallocated	1984	6.4	0.6	0.4	1.7	0.5	4.3	0.1
	1985	6.7	1.0	0.4	1.6	0.6	5.9	0.1
	1986	6.6	1.0	0.4	1.6	0.6	6.2	0.1

Source: TD/B/C.4/309 page 11-12 - compiled on the basis of data supplied by the Shipping Information Services of Lloyd's Register of Shipping and Lloyd's of London Press Ltd.

a/ Excluding the United States Reserve Fleet and the United States and Canadian Great Lakes Fleet.

b/ Ore and bulk carriers of 6,000 grt and above, including combined ore/oil and ore/bulk/oil carriers.

c/ Including passenger cargo vessels.

d/ Including Yugoslavia as of 1986.

Table 11

Distribution of the world fleet and TEU capacity of fully cellular containerships by groups of countries, at mid-year 1984, 1985 and 1986

Flags of registration by groups of countries	Number of ships			TEU capacity and percentage shares a/		
	1984	1985	1986	1984	1985	1986
World total	900	970	1,023	832,112 (100.0)	942,222 (100.0)	1,087,775 (100.0)
Developed market-economy countries	496	516	503	532,229 (64.0)	577,915 (61.3)	638,068 (58.7)
Open-registry countries	161	176	193	100,217 (12.0)	122,290 (13.0)	161,399 (73.5)
Total 2 and 3	657	692	696	632,446 (76.0)	700,205 (74.3)	799,467 (73.5)
Socialist countries of Eastern Europe and Asia	61	75	96	33,340 (4.0)	47,963 (5.1)	63,144 (5.8)
of which						
In Eastern Europe	49	48	59	23,902 (2.9)	25,671 (2.7)	33,078 (3.0)
In Asia	12	27	37	9,438 (1.1)	22,289 (2.4)	30,066 (2.8)
Developing countries	147	156	177	120,968 (14.5)	123,600 (13.1)	146,813 (13.1)
of which						
In Africa	-	3	3	-	585 (0.1)	585 (-)
In America	11	16	23	2,018 (0.2)	3,873 (0.4)	7,279 (0.7)
In Asia	136	137	146	118,920 (14.3)	119,142 (12.6)	135,792 (12.5)
In Europe	-	-	5	-	-	3,157 (0.3)
In Oceania	-	-	-	-	-	-
Other, unallocated	35	47	54	45,358 (5.5)	70,454 (7.5)	78,351 (7.2)

Source: TD/B/C.4./309 Page 14 - Compiled for Shipping Information Services of Lloyd's of London Press Ltd.

a/ Percentage shares are shown in brackets.

CHAPTER 2

PRINCIPAL CHARACTERISTICS OF THE WORLD CONTAINER INVENTORY AND THE SITUATION OF AFRICA

2.1 The importance of containerization

Many volumes of books and articles have already been written on this subject and more will be written. The container in the meantime has established itself as the means of transportation of the hour and is here to stay.

The importance of the container in the world and in Africa lies in the very superiority of the general economics of containerization· faster vessel discharge/loading and improved utilization of ships and port facilities (Annex 1). Certainly in Africa, one of the main attractions of containers is the greater ease and security of cargo handling. This advantage will be more felt in the context of door-to-door intermodal transport. Also, containerization increases port productivity. This has been a great relief for most ports in Africa as they were faced with serious problems of port congestion in the late 1970s and early 1980s. A number of ports which could not cope with increased break bulk traffic like Lagos/Apapa Abidjan, Dar-es-Salaam etc. are now able to do so by converting old berths or building new container berth. This process is still going on in certain areas of this region.

In other trade routes, like the US/Latin America trade route, containerization has been reported to have brought about a reduction in ocean freight rates. It was reported in 1970 that during the period 1958-1970 the overall cost of moving container commodities had reduced by 13.4 per cent (Annex 1). In Africa, this seems not to be the case. A study undertaken by Lambert Brothers Ltd. for UNCTAD Sipping Division in 1982 suggests that the ocean freight rates in this region have, on the contrary been on the rise. This could also be confirmed by the almost yearly negotiations over freight rates which the conference lines and independent lines hold with major shipper organizations like the negotiationscommittee of the Ministerial Conference of West and Central African Countries on Maritime Affairs and the Intergovernmental Standing Committee on Shipping (ISCOS) in East Africa. However, this aspect aside, when the high ocean freight rates are discounted for improvements in port utilisation, cargo handling, security in transportation and other benefits, the effect of containerization on total transport costs to Africa could generally be found to be positive.

For the shipping lines the advantages are clearly marked in Table 12. In 1980 when containerization was merely catching up, a fully cellular container vessel of 19,000 dwt called at an average of seven ports in 19.3 days per voyage in West Africa, spending only 1.5 days per port on the average. Whereas a semi-container vessel of 14,000 dwt called at fewer ports (4.3) and yet spent on the average 22.8 days per voyage in West Africa and 3.81 days per port. See also Annex 2.

The degree of containerization of African trade is summarised in Table 13. The West African sector of the region is more containerized than the East and North although all sectors in the region are medium level or below in the degree of containerization compared with other routes in the world.

Table 12

Analysis of West African port calls
January - March 1980

Type of vessel	No. of Ports in West Africa per voyage	Days in West Africa per voyage	Average days per port	Average size of ship (CWT)
Fully cellular containership	6.6	19.3	1.50	19,245
Ro-Ro cargo	3.2	9.3	1.52	6,451
Barge carrier	1.7	4.0	1.65	21,800
Semi-containership	4.3	22.8	3.81	14,195
Refrigerated ship	1.9	14.2	6.43	5,244
Other cargo ship				
- regular	3.6	28.6	5.77	8,207
- non-regular	2.3	19.2		8,218
Tankers 0-50,000 DWT	2.7	12.6	8.18	20,158
Tankers 50,000 DWT +	1.3	5.7	3.87	163,153
Bulk and ore carriers	1.8	11.6	4.88	38,678
Combined carriers	1.2	4.3	2.06	99,743

Source Final Report to MINCONMAR by Lambert Brothers Shipping Limited, UNCTAD consultants (Raf.78/011) June 1982 Pg. 23.

Table 13

General trends concerning the degree of containerization and the ship types used in container trades (1985)

From/to To/from	Europe		Japan/Far East		USA	
East Africa	M	FC/SC/RR/CONV	L	CONV	L	SC/CONV
West Africa	M	FC/SC/RR/BA + FC/CONV	L/M	RR/CC/SC/CONV	M	RR/SC/BA/CONV
Red Sea	M	FC/SC/RR	M	FC/RR/CONV	M	FC/RR/BA
Middle East	H	FC/SC/RR/BA	H	FC/SC/CC/RR	H	FC/RR/BA
Caribbean	M	FC/RR	L	SC	M	FC/SC/RR/BA
Central America Mexico/Venezuela/ Colombia	M	FC/SC/CC/RR	L	FC/SC	M	RR/SC
East coast South America	L/M	FC/SC/CC/CONV	L	SC/CONV	M	SC/CONV
West Coast South America	L/M	FC/SC/CC/CONV	L	FC/SC/CONV	L	SC/CONV
Indian sub-continent	L/M	SC/CC/RR/BA/CONV	L	SC/CONV	L/M	FC/SC/CC/BA/CONV

Level of containerization
H = High
M = Medium
L = Low

Ship type
FC = Fully cellullar
SC = Semi-container
RR = Ro/Ro
CC = Converted/fully cellular
BA = Barge carrier
CONV = Conventional

Source: G. De Monie "Alternative Containership and Terminal Systems[Layouts and Operational Features of Pure and Combined Terminals," UNCTAD/SHIP/612 Pg. 85.

2.2 Size and potential growth

According to the latest count made by Containerization International, taken during the early 1986, there were 4.8 million containers in TEU in existence world wide. At the moment, the number in TEU must be higher and is well over the 5 million TEU mark. The figure represents about 3.6 million units of containers (Annex 1). Comparing the 1986 figures with those of 1983, it shows that the world container inventory has increased by 1 million TEU and the total fleet of containers had grown by 600,000 over the same period. This reflects the strong purchase of the 40 FT container units, mainly by shipping lines for use in the transpacific trades but also to balance the oversupply of the 20 FT containers which had marked the early 1980s. It is estimated that by the 1990, the container will have reached the 8 million mark (Annex 1). This certainly indicates that the maintenance and repair of containers is an industry with a lot of potential for the future. This growth will certainly affect the level of containerization in this region. This therefore, calls for the countries of the region to now pay more attention to the container itself in addition to their efforts in port improvements, ships, road and rail facilities and inland container depots now in the process of being set up in many parts of the region.

2.3 Types of container

Types of container used in the African region borrow much of their characteristics from those of the world since containerization is a international industry. Types of container could be analysed by use, age, length and height, common cladding type and equipment cost.

Table 14

Age breakdown of world TEU fleet
in terms of standard and special types

Period	Standard	Special 1/	Special as % of total
Pre-1970	65,000	17,500	21
1970-75	291,500	81,300	21
1976-77	320,000	63,700	16
1978-79	769,000	118,700	13
1980-81	944,700	138,100	12
1982-83	716,0..	143,900	16
1984-85	985,000	124,500	11

1/ Term "Special" or "Specialized" container can be a designation that it is not ISO standard or that it is designed to carry a special commodity.

2.3.1 Type by use

Containers are generally classified into two types· general purpose and specialized. General purpose containers are found in many different types and configurations like open tops, general ventilated etc. Specialized containers also come in different types according to the trade route or types of product to be carried, like reefers and tank containers. A summary of container types and their description is given in Annex 3. Also, Annex 4 gives a pictorial example of typical containers and their dimensions.

Most of the containers on the market are standard containers. A small proportion of them are special containers. As at the begining of 1986, 89 per cent of the world equipment as standard containers, 11 per cent as specialized as shown in Table 14. However, when weighted the specialized units make up 14.4 per cent as shown in figure 3.

In this region, however, the percentage of special equipments like reefers and tank containers range between 5-10 per cent depending on the port. For West Africa, one of the shipping lines estimated 90 per cent standard units and 10 per cent special units like reefers and tank containers. For the same region one conference line put at 92 per cent standards and 8 per cent reefers. East African estimates were 95 per cent standard equipment and 5 per cent reefers. The reefer units in East Africa are expected to rise due to the growing confidence that the perishable goods industry has in sea transport by reefers. Also, they are increasingly pushed out of air freighting by high air freight rates and declining profit-margins especially for the fruit industry and flowers. On the average, therefore, 90 per cent of the units in this region are standard and 10 per cent special ones.

Table 15

Age breakdown of world TEU fleet in Terms of commonest lengths

Period	20FT	40FT
Pre-1970	15,829	26,966
1970-75	138,406	202,728
1976-77	245,566	132,768
1978-79	499,694	379,018
1980-81	687,907	392,190
1982-83	466,320	383,540
1984-85	371,609	729,198

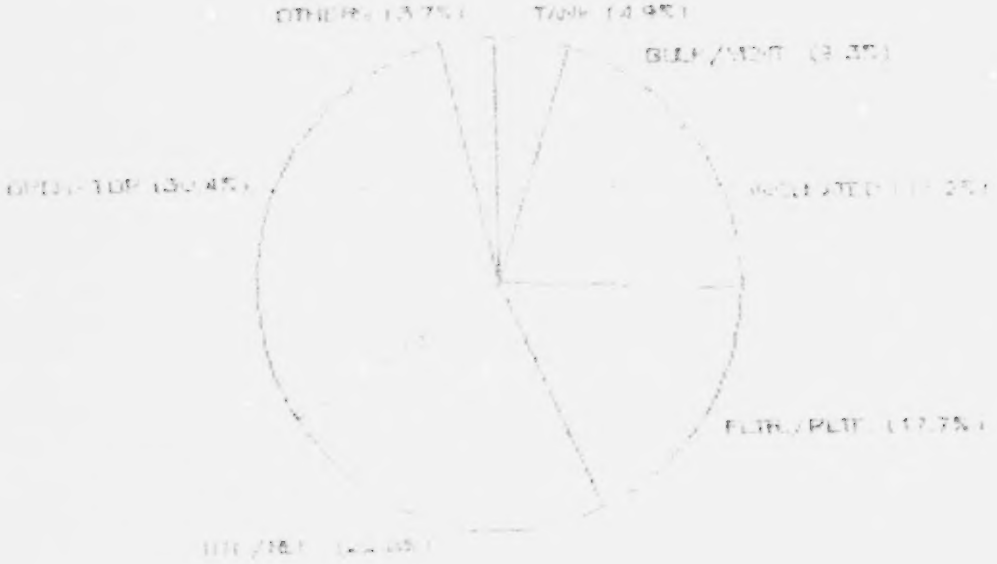


Table 16

World container population by length and cargo type (at beginning of 1986, actual units) (Annex 1)

Type	20FT units	%	40FT units	%	35FT units	%	Total units	%
General cargo	2,030,098	56	990,612	27.3	26,747	0.8	3,077,281	84.9
Others	395,233	10.9	132,592	3.7	9,735	0.2	545,811	15.1
Total	2,425,311	66.9	1,123,204	31.0	36,482	1.0	3,623,092	100

2.3.2 Type by age

Table 14 and 15, among other things, give an indication of the age profile of the world fleet. Looking at the total TEU fleet, it can be calculated that a sizeable 82.4 per cent had an age below eight years in January 1979 to 1984-85. Average age of the inventory was five years.

In this region, the ages of containers ought to be comparable to those of the world fleet. West Africa and North Africa seem to be very much the case. However, in East Africa, the experience of ports is that older container units are more and more sent to the area probably due to higher risks of damage of containers experienced by unit owners in that area.

2.3.3 Type by length and height

An impressive 2.03 million dry freight containers were of 20FT length, (Table 16). This represents 56.0 per cent of all the dry freight containers. This is followed by the 40FT containers with 990,612 units representing 27.3 per cent. Although the 20FT containers lead in units the 40Footers are quickly catching up in total TEU. For example in 1986, the 40Footers recorded about 1.98 million TEU. Parity is expected to reached by the end of 1987 (Annex 1). The rapid growth of the 40 container is shown in Table 15.

Regarding height, container dimensions have continued to increase from 8' to 9'06". Also in width from 8' to 8'06". Table 17 shows the world container population in units by height and type. The 8'06" heights made up 89.7 per cent and the 9'06" made quite an inroad with 5 per cent by the end of 1986.

The less favoured lengths like the sizeable holding 8' high port hole reefer, 8' height tank and bulk containers have continued being dropped to the much favoured 8'06" equipment. The 8' equipment had dropped from 6.0 per cent recorded early 1986 to 3.3 per cent at the end of 1986 (figure 4). It is expected that the 8' heights will be phased out of the market within the next two or three years. Occassionally these low heights reach the region. They are very rare. For example in Abidjan they handled only 3 units of the low heights in 1986.

In the African region, it is the 8'06" which is more popular followed by the 9'06". Container dimensions by height are rarely recorded in African ports. What interests them most is the TEU capacity.

FIG.4—% BREAKDOWN OF WORLD FLEET

FIG.3-2 BREAKDOWN OF WORLD FLEET

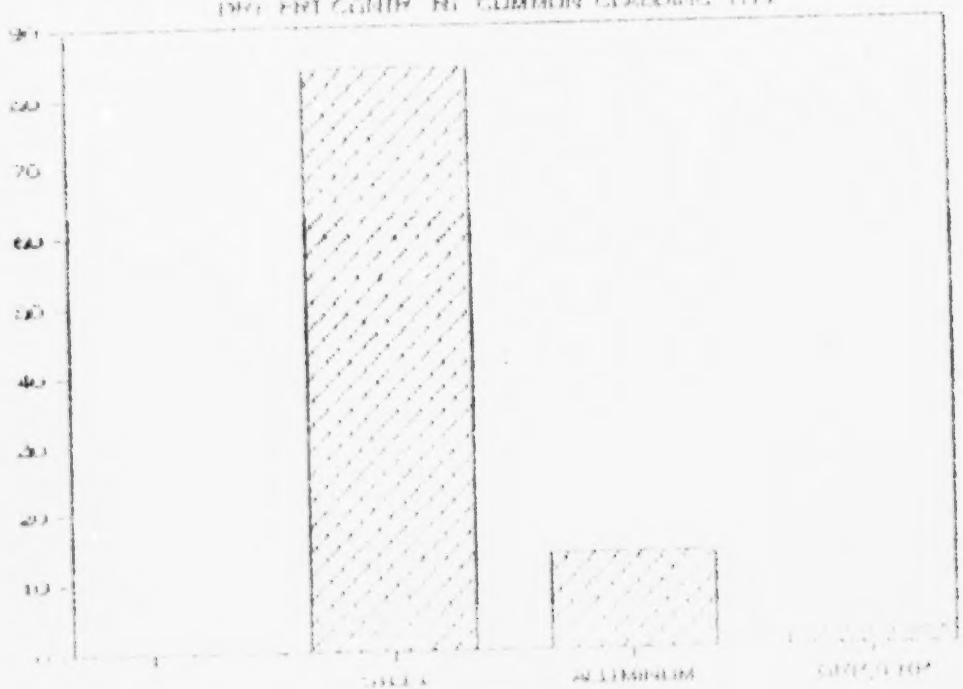


Table 17

World container population by height and type (at the beginning of 1986, actual units) (Annex 1)

Height	20FT	40Ft	35FT	Other	Total	%
8'	201,539	1,738	214	13,455	216,946	6.0
8'06"	2,185,102	1,013,318	35,668	13,385	3,250,473	89.9
9'	381	7,799	0	0	8,180	0.1
9'06"	1,971	93,269	0	8,082	103,322	2.9
Others	36,338	7,080	600	153	44,171	1.1
Total	2,425,331	1,123,204	36,482	38,075	3,623,092	100.0

2.3.4 Type by common cladding

There are mainly three types of container cladding or material out of which equipment is made. These are the steel, aluminium and fibre glass GRP or fibreglass reinforced (FRP) plywood.

The steel-clad containers are the most popular the world over (figure 5) probably because of durability and ease of maintenance and repair. The container maintenance and repair industry thrives upon this container cladding type. In 1986, the steel-cladded units made up 84 per cent of the dry freight fleet followed by aluminium with 14 per cent and GRP with 1.9 per cent.

In this region, the experience is that the steel container is the most popular. Estimates differ from port to port. In West Africa, the estimates made in Abidjan are 90 per cent steel and very few GRP which meant that the larger proportion of the remaining types were aluminium. In East Africa it was put at 82 per cent steel and others together taking the remaining share. This makes the traffic characteristics comparable to the world. Also it shows that, like in other regions of the world, the maintenance and repair work expected in this region will be predominantly that of steel equipment.

2.4 Ownership and cost of containers

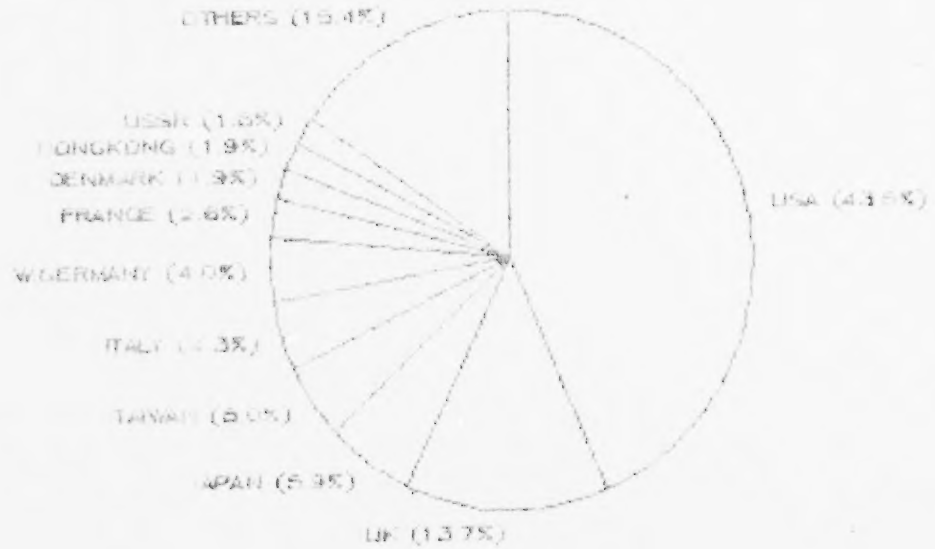
Like the case of containerships, container units are owned by the traditional maritime countries or the developed market regions. Figure 4 shows that at 1 January 1986, 43.5 per cent of the world container fleet as owned by the US and particularly the US based "Big Seven" container leasing companies representing more than 2 million TEU. Other owners by countries are United Kingdom 13.7 per cent, Japan 5.9 per cent, Taiwan 5.0 per cent, Italy 4.3 per cent, West Germany 4.0 per cent and France 2.6 per cent (figure 6). Countries appearing under "others" include Switzerland with its sophisticated container leasing industry, South Korea, Netherlands, Israel, Poland and East Germany.

Furthermore, in 1986, the carriers and lessors controlled slightly differing mixes of standard and special containers . Owning around 2.13 million ETU in dry freight standard containers, the lessor-owned fleet

outnumbered carrier-owned inventories by almost 16 per cent or 292,000 TEU. The shipping lines owned about 1.78 million TEU. Even, shipping lines owned 20 per cent more special units than did the lessors representing 352,000 TEU as opposed to 295,000 TEU owned by lessors.

Fig.6—Prontge Brkdwn of Shres of Wrld

Cntnr Fleet (TEU) hld by Top 10 Cntries



Therefore, container lessors held 52 per cent of the global TEU as at the end of 1985, together with 43 per cent of special equipment, leaving carriers controlling 45 per cent of all standard units and 51 per cent of all special units of equipment. The "other" category accounted for the remaining 3 per cent share of standard and 6 per cent special container units.

Similarly lessors controlled the highest proportion of 20 FT containers in service, 55 per cent of the world total fleet representing 1.34 million TEU. Whereas the carriers owned 40 per cent and "others" 5 per cent. However, in the 40FT category, carriers controlled more units than lessors. Overall it is the lessors and carriers who control the major portion of the units. Therefore, when one talks of container damage and repairs, these two groups are the ones on the receiving end in terms of operational problems but in revenue recovery out of damage and repair, it is mostly the users or shippers who meet the cost passed down to them by fleet owners.

In this region ownership of containers is in the hands of the carriers who either operate leased equipment or owned equipment. Very few are owned by carriers of the region because they own very few cellular ships or TEU slots. Only 3 per cent of the equipment is owned by shippers (foreign ones), in this region. About 80 per cent is standard and about 8-10 are special units. Most of the units are the 20' equipment. However, the proportion differs from port to port. For example, Port Sudan recorded 10 per cent 40' units, in Djibouti 7 per cent were 40' whereas Douala and Lome reported 2.4 per cent. Most ports have 90 per cent 20 footers and 10 per cent 40 footers. Therefore, the position in the region is similar to that of the rest of the world.

One of the limiting factors for the ownership of containers by shippers certainly in this region is cost. The cost of a general purpose container is greatly affected by market conditions. The price of a steel general purpose 20' unit would range from $US 1,800 to $US 3,000 depending on the quantity purchased and country of production.

The price spread on the 40' unit has about the same spread with the medium price being around $US 4,000. Options like corten steel, fork pockets etc. increase the unit price proportionately. Aluminum containers are more expensive than steel ones and also more costly to repair. Reefers are even more expensive, 40' and insulated will have a price range from $US 8,000 to 10,000 depending on the location of manufacture. The reefer machinery costs an additional $US 10,000 - $US 15,000. Class II tank containers have a price range from $US 18,000 - 25,000 per unit with leadtimes of up to six months. This clearly shows that a container is not a small matter in terms of cost. So shippers in this part of the region find this equipment expensive to buy for their own use except where in the case of imports, certain manufactures of commodities quote their prices inclusive of the price of the container. Such containers are found everywhere in shippers' yards, office blocks, etc.[some are converted into accommodation or workshops.

The cost aspect can be clearly understood if we assume that all the 20' containers mentioned in Table 16 are ordinary general purpose units. The total cost at an average of $US 3,000 per unit for the current world inventory could be about $US 609 million. Certainly the figure is much higher than this if special units are included. In view of this cost, the container deserves better handling and attention at sea, in port and in the hinterland than is the case at the moment, particularly in this region.

2.5 Types of products transported by container in Africa

The types of product imported in containers are generally manufactured goods, motor cars, steel products, machinery of various shapes and sizes, spare parts, personal effects, etc., whereas products of export in containers are pre-dominantly raw materials and semi-processed raw materials, cocoa, coffee, tea, tobbacco, etc. Almost all African dry freight cargoes can be containerized. This has been confirmed by two studies undertaken in the region in recent years. One by the Lambert Brothers Shipping Ltd. found out that "most West African exports can be containerized by shippers or at the convenience of the shipping line, with the exception of logs and typical non-liner cargoes such as iron ore, clinker or phosphates, cotton, cocoa, coffee, cocoa butter, tobacco, plywood, veneers, even sawn timber and low value cargoes, such as shea-units can be and have to some extent been shipped from West Africa in containers (Annex 1).

In another study by K. Thomas, consultant for UNCTAD, a similar finding was reported for East Africa.

"The commodity composition of liner-type cargoes moving between East Africa and the United Kingdom/North West continent (for the year 1981) was analysed in figure 11. It is a striking feature of the analysis that most of the trade is physically capable of being transported in containers. For north bound, virtually 100 per cent could be loaded into containers and south bond 85 per cent."

Therefore, there is no excuse as far as the acceptablity of cargo for containerization is concerned. There seem to be other reasons or problems which may be influencing shippers against using containers. The matter needs further and thorough investigation as it does stand at the heart of success or failure of the maintenance and repair industry in the region.

However, a general view of the matter seems to suggest that certain aspects of the behaviour of the container trade in the region could be responsible[like[(i) the lack or the additional cost, of inland facilities to supervise the loading of containers[(ii) the container freight rate is the same as the breakbulk commodity tariff, the shipper would be forced to ship break bulk, if containerization involved him in payment of additional cost for tallying and inspection[(iii) even the fees and charges for loading, handling, unloading and inspecting containers are high and could be possible impediments[(iv) the shipper is given no real financial incentive to ship in containers as some carriers had been given at the beginning of containerization when rebates were offered by ports for higher shipments of containers.

The matter requires the full attention of the region to ascertain the causes of low rates of container use especially in the export trade and what the region could do about it as this feature affects many aspects of the container industy including the establishment and development of the container maintenance and repair industry.

2.6 The flow of containers through African ports

The development of container transport in this region could be traced to the mid-1970s when almost all the major ports, their authorities and governments were debating the concept of containerization, whether or not it was advantageous (we have passed that stage). While this was going on, and through strong economic pressure from Europe on the European flag shipping lines, containers began to arrive in African ports. As in other developing countries, the initial attitude to the container in this region was lukewarm. This attitude in fact led to insufficient allowance being made in subsequent major investments in this mode of transport.

The world port container throughput increased rapidly between 1975-80. This was also the period of massive fleet build-up and investment in modern port facilities by most container interests in developed countries as shown in Table 1(b). This increase dropped from 1981-82 to a level of 6.3 per cent in 1985 (Table 19). The rise in throughput in 1984, which also turned many shipping lines to profitability, was largely the result of a cyclical upturn in world trade associated with the strength of the US dollar rather than the penetration of new markets (Annex 1).

Table 18

Analysis of regional container throughput growth
1970/85 (thousand TEU)26/

Region	1970		1975		1980		1985		1990		2000	
	TEU	%	TEU	%	TEU	%	TEU	%	TEU	%	TEU	%
Scandinavia/Baltic	202.7	3.2	698.1	3.8	1034.3	2.8	1378.8	2.5	1799.9	2.4	2455.6	2.1
North Europe	2144.4	33.9	4354.7	23.7	7150	19.2	9748.7	17.5	12636.0	16.6	17369.1	15.2
Atlantic Europe	146.3	2.3	597.9	3.3	1428.2	3.8	2143.7	3.8	2920.4	3.8	4397.5	3.8
West Mediterranean	184.1	2.9	542.0	3.0	1585.7	4.2	2559.9	4.6	3570.4	4.7	5350.0	4.7
East Mediterranean	15.3	0.2	148.5	0.8	744.9	2.0	1176.3	2.1	1679.5	2.2	2656.2	2.3
North Africa	-	-	27.8	0.2	183.5	0.5	346.5	0.6	594.4	0.8	1246.9	1.1
West Africa	8.2	0.1	83.7	0.5	491.5	1.3	653.2	1.2	848.7	1.1	1175.2	1.0
South Africa	5.0	0.1	68.3	0.4	579.6	1.6	682.2	1.2	766.8	1.0	1105.9	1.0
East Africa	0.1	-	10.4	0.1	101.3	0.3	265.9	0.5	673.5	0.9	1412.1	1.2
Middle East	13.4	0.2	197.0	1.1	1804.7	4.8	2748.2	4.9	3743.9	4.9	5600.6	4.9
South East Asia	16.2	0.3	441.0	2.4	2107.8	5.6	4001.0	7.2	6559.7	8.6	11994.2	10.5
Far East Asia	471.1	7.5	3037.9	16.6	7277.4	19.5	12306.6	22.1	17164.6	22.6	25814.2	22.5
Austral Pacific	323.4	5.1	884.0	4.8	1562.9	4.2	1823.5	3.3	2258.3	3.0	3230.4	2.8
North America EC	1286.4	20.4	3748.5	20.4	4649.0	12.5	5606	10.1	6709.2	8.8	8948.3	7.8
North America/Gulf	242.0	3.8	806.6	4.4	1456.8	3.9	2336.5	4.2	3245.7	4.3	5337.9	4.7
North America WC	1203.1	19.0	2392.9	13.0	3810.6	10.2	5709.2	10.2	7410.7	9.8	10615.6	9.3
Latin America Carribbean	18.3	0.3	215.2	1.2	881.9	2.4	1330.4	2.4	1908.5	2.8	3167.6	2.8
Latin America South	37.0	0.6	91.5	0.5	460.9	1.2	930.3	1.7	1490.9	2.0	2719.6	2.4
Total	6316.9	100.0	18346.0	100.0	37310.9	100.0	55747.0	100.0	75981.1	100.0	114596.9	100.0

Table 19

World port container traffic
(million TEU)25/

Year	Through put	% Increase on previous year
1975	17.4	-
1976	20.2	16.1
1977	23.0	13.9
1978	26.6	15.7
1979	32.0	20.3
1980	37.2	16.3
1981	40.9	9.9
1982	42.5	3.9
1983	44.5	4.7
1984	52.7	18.4
1985	56.0	6.4

The drop in world throughput does signify a movement towards completion of penetration particularly in developed countries and trade decrease due to worldwide recession. Despite the temporary drawback in the throughput, it is estimated that container throughput would rise to hit the 75-80 million TEU by 1990.

Compared to the world container throughput, Africa's share is still relatively small. For example (Table 18), during the initial stages, in the early 1970s, Africa held only an average of 0.1 per cent of the total world throughput. This increased to 0.8 per cent, 2.1 per cent and 2.3 per cent for 1975, 1980 and 1985 respectively.

Individual ports in the region have had varying experiences. On the whole there has been an increase in the container throughput in the ports of the region. There is every reason to believe that the increasing trends in the container traffic will continue taking into account the low level of container penetration in the region.

As at the beginning of 1987, only four ports in the region, excluding South African and Canary Island ports, recorded container throughput of 100,000 TEU and above (Map and Table 20). While ten recorded a throughput of between 25,000-99,999 TEU and 24 ports reported a throughput of below 25,000 TEU (see also Annex 5). Table 20 gives the performance of five ports with relatively higher TEU capacity, four above 100,000 TEU and one Douala below 100,000 TEU. For these ports, their combined throughput for the period 1980-86 was 4.1 million TEU represented by 2.7 million TEU loaded and 1.4 million TEU empty equipment were handled. The highest throughput was in Lagos/Apapa with a total throughput of 1.3 million TEU represented by about 0.74 million TEU loaded and 0.5 million TEU empty equipment[thereby recording at the same time the highest number of empty export containers in the region.

The majority of the ports are in a similar position to Lagos/Apapa with the exception of Abidjan, Douala, Matadi and Mombasa which ports have a relatively high level of cargo exported in containers. However, this position is expected to improve in future with the increase in the level of container penetration in the region.

Africa
Ponta Delgada
Porto Santo
Funchal
Tanger
Casablanca
Algiers
La Goulette
Tripoli
Benghazi
Alexandria
Port Said
Santa Cruz de Tenerife
Las Palmas
Nouadhibou
Port Sudan
Banjul
Assab
Djibouti
Conakry
Freetown
Monrovia
Abidjan
Lagos
Apapa
Warri
Port Harcourt
Calabar
Douala
Libreville
Port Victoria
Mombasa
Dar-es-Salaam
Nacala
Tamatave
Beira
Walvis Bay
Maputo
Durban
Cape Town
East London
Port Elizabeth
Georgetown
KEY
One million TEU +
250 000 TEU +
100 000 TEU +
25 000 TEU +
10 000 TEU +
Other ports

2.7 Containerised trade flow imbalance in Africa and impact on demand for container repair services

Table 20 summarizes the characterstics of the container throughput in African ports. Most ports except a few like Abidjan, Douala, Matadi and Mombasa, receive loaded containers as imports and send them away, as export, empty. The large ports like Lagos/Apapa and Alexandria are more affected in this regard.

Containerized trade flow imbalance can also be looked at from the loading of the shipping lines. It is common knowledge that if the container throughput at ports is imbalanced, container ship loadings will also be imbalanced. However, ship loading imbalance in containerized cargoes mainly explains the inherent imbalance in the trade between import and export whereas the port traffic, at this level of containerization, reflects mainly the degree of containerization of the trade. So the movement of empty containers at this level of container development is due to the low export usage of containers and not to the imbalance trade since on the same ship carrying empty containers has been found a large proportion of containerizable break bulk cargoes.

Table 21 and 22 show the average of cargo carried per voyage for shipping conferences (freight tons) and the derived ratios respectively. All the conferences recorded an imbalanced trade with West Africa, the degree varying according to the trade[the highest ratio of import to export is 6·1 in the Far East trade, 1982. The rest of the region trade routes are in a similar position with the current average for the region being about 3.5·1 for import and export respectively. As explained in the foregoing paragraph, this ratio is not the main reason for the imbalance between loaded and empty containers in the region. The imbalance between loaded and empty is due to low container usage in the export leg of the voyage. The reasons for this behaviour need thorough investigation at regional level and action also to be taken at regional level accordingly.

Table 21

Average cargo carried per voyage by conference lines West African Trade (freight tons)

Conference		1982	1983	1984	1985	1986
AWAFC·	E. Bound	-	-	7,699	-	-
	W. Bound	-	-	3,372	-	-
Ratio (E·W)				2.3·1		
FEWAC·	W. Bound	13,279	16,643	17,323	18,967	19,000(i)
	E. Bound	2,854	4,160	4,928	6,440	7,000
Ratio (E·W)		6.4·1	4·1	3.5·1	2.95·1	2.7·1
UKWAL	S. Bound	11,156	13,315	14,282	14,054	14,204(E)
	N. Bound	2,782	4,197	4,552	3,532	4,788
Ratio (S·N)		4·1	3.2·1	3.1·1	3.97·1	2.96·1
MEWAC·	S. Bound	-	-	9,356	10,319	10,300
	N. Bound	-	-	8,978	8,550	8,500
Ratio (S·N)		-	-	1.04·1	1.2·1	1.2·1
CEWAL·	S. Bound	-	-	-	10,851	10,851(E)
	N. Bound	-	-	-	5,014	5,014
Ratio (S·N)		-	-	-	2.16·1	2.16·1
COWAC	S.Bound	12,073	11,903	12,247	12,696	12,300(E)
(N. Section)	N.Bound	4,177	5,839	5,905	4,465	5,770
Ratio (S.N)		2.89·1	2.03·1	2.01·1	2.3·1	2.13·1
COWAC (S.Section)						
	S. Bound	11,740	12,226	13,212	15,707	15,200
	N. Bound	7,856	9,370	11,193	10,329	9,400
Ratio (S.N)		1.49·1	1.3·1	1.18·1	1.5·1	1.6·1

(E)· Estimates according to voyage results forcasts
(i)· Interim period · 9 months to 30.9.86
AWAFC· America.West Africa Freight Confernce
FEWAC· Far East/West Africa Conference
UKWAL· United Kingdon/West Africa Lines Joint Service
MEWAC· Mediterranean Europe/West Africa Conference
CEWAL· Associated Central West Africa Lines
COWAC· Continent West Africa Conference

Table 22
Cargo movement ratios by conference

	1982	1983	1984	1985	1986	Average
AWAFC(E·W)	-	-	2.3·1	-	-	2.3·1
CEWAL (S·N)	-	-	-	2.16.·1	2.16·1	2.16.1
FEWAC (W·E)	6.4·1	4·1	3.5·1	2.95·1	2.7·1	3.91·1
UKWAL(S·N)	4·1	3.2·1	3.1·1	3.97·1	2.96·1	3.45·1
MEWAC (S·N)	-	-	1.04·1	1.2·1	1.21·1	1.15·1
COWAC (N)(S·N)	2.89·1	2.03·1	2.07·1	2.3.1	2.13·1	2.28·1
" (S)(S·N)	1.49.1	1.3·1	1.18·1	1.5·1	1.6·1	1.14·1
Average	3.7·1	2.6·1	2.19·1	2.35·1	2.13·1	2.5·1

The provision of container repair services reflects the local needs, flows and export usage (Annex 1).

"If the export container usage for any given country is dynamic, stagnant or depressed, so will be the container repair industry".

The most crucial aspect affecting demand of repair services in Africa is the lack of export usage of containers. The logical practice for repair of units would be to repair the unit as soon as possible and when damaged. The position shifts if the owner does not envisage any revenue from the trade. This is the case for this region. Already market activities, and needs for container repair in countries with higher export usage like Abidjan are higher than in no export usage ports. Furthermore, the high export usage ports also happen to be re-positioning points. Large quantities of empty containers are received by re-positioning ports for export loading. It is at this point that demand for containers and the consequential demand for repair of those units found to be in a damaged condition is highest. Therefore, the demand for container repair services is higher in Abidjan along the West African coast than in any other port in that sub-region. Similarly for Mombasa in the other sub-region. The Port Autonome d'Abidjan has been approached by European firms for land to put up container repair workshops but they have so far been turned down because the port itself is actively considering establishing one. In Mombasa, the few firms and numerous welding companies accepting repair of container units are an indication of the demand for that service. The move by Compagnie Maritime Belge (CMB) to set-up a repair yard for its own fleet service is another definite indication of high demand in that region for this service.

The two ports mentioned are in a critical stage of the requirements for elaborate container maintenance and repair services. Other ports following along these lines are Douala, Matadi and Djibouti. The North African sub-region is in a very peculiar position in that· (i) there is very very little, if any, inter-regional trade (ii) their shipping services are vertically oriented to the Mediterranean ports of Europe (iii) the container maintenance and repair industry of Mediterranean Europe maintains and repairs containers to and from that sub-region and it would be difficult for that sub-region to compete with them because of the nearness to home port for most shipping lines.

2.8 Cost of imbalanced container trade flow

The cost of the container itself is discussed under paragraph 2.4. The cost to the shipowner is also partly expressed. However, it is higher than that. For example, taking a modern semi-cellular container vessel (which is the most popular in the region), with a 500 TEU capacity could cost about $US 15 million new. For smooth operation it needs three sets of containers. Assuming each unit costs $US 3,000, the three sets of 500 containers needed for such a vessel could represent an additional investment of about $US 4.5 million (+30%). If the 1,500 containers were hired at $US 1.65 per TEU per day, instead of being purchased, the annual container leasing cost would be $US 903,375, equal to 6 per cent of the capital cost of the ship. An imbalanced trade would mean considerable cost of hire without any contribution to the revenue recovery "POT".

The disadvantages of an imbalanced container flow and particularly the low container export usage does not only end with the adverse effects on container maintenance and repair sectors. It also costs the region a lot of money and foreign currency in passed-on costs.

To a shipowner or unit lessors empty containers cost them in terms of cost of transporting an empty container, leasing or hire costs and other incidental costs. Tables 23 and 24 gives these costs to the shipowners in percentage and in US dollars. These costs are either wholly or partially recovered from this region by passing on these costs to the region through higher freight rates or inflated CIF value of exports if units are owned by consignees based in European countries.

The cost of this imbalanced trade could be better perceived by making a calculation of the estimated cost for three ports, one highly imbalanced, Lagos/Apapa, medium low, Abidjan and low, Mombasa. The following assumptions are made, (i) that throughout the period, 1980-86, for the ports selected, reasons for empty import containers are repositioning for cargoes to be loaded in those ports (ii) all deep sea containers from developed countries are fully laden (iii) all empty containers exported were in good and serviceable condition (iv) only the full cost of transporting the empty containers is passed-on to the region in the form of higher freight rates or higher CIF (v) cost of transportation is the same between West and East Africa to Europe, (vi) the leasing or hire costs, repair costs, etc. are not recoverable, (vii) that all dry freight cargo can be containerised, (viii) and that all empty containers are returned in owners' vessels.

Table 23

UKWAL container fleet costs - 1986
analysis of costs of container fleet

	Percentage
Leasing costs	30
On hire costs	6
Repair costs	17
Return to UK costs	27
Positioning costs	6
Insurance	2
Agency fees	6
Storage costs	4
Sundry	2
Total	100

Table 24

Average cost of running empty containers to USA/Europe

Loading empty container West Africa	$US 60
Lashing/unlashing	15
Discharging USA/Europe	100
Drayage costs to container depot	50
Drop off charge/lift off/survey	100
Agents container handling fee	25
USA gate handling fee	50
Chassis	16
Ocean freight for empty container on owners'vessel	250
Total cost on owners' vessel	$US 666
Ocean freight by non owners' vessel	$US 750
Total at non-owners' vessel	$US 1,166

Then, taking figures in Table 20 and 24 the estimated cost of imbalance to each coastal country represented by those ports would be as shown in Table 25. The cost to Nigeria would be on the average $US 50.4 million per year. Cote d'Ivoire, $US 13.6 million per year and Kenya $US 3.3 million per year. The higher the level of imbalance the more the cost. The aggregate cost for the whole region is higher than this. There is, therefore, a need to investigate the underlying causes of the resistance of the trade to increased use of containers in their export trade. Thereafter concerted action is required to remove any impediments thereof to save the region this loss of needed money and foreign currency.

Table 25

Cost of transporting empty containers ($US)

	1980	1981	1982	1983	1984	1985	1986	Average
Abidjan								
Empty TEU	16,781	22,085	22,778	20,421	19,570	22,596	19,070	20,471.5
Cost	11,176,146	14 708,610	15,170,148	13,600,386	13,033,620	15,048,936	12,700,620	13,643,019
Mombasa								
Empty TEU	3,541	3,909	4,755	4,317	5,994	5,327	7,004	4,977.9
Cost	2,358,306	2,603,394	3,165,498	2,875,122	3,992,004	3,547,782	4,664,664	3,315,252.9
Lagos/Apapa								
Empty TEU	85,135	108,825	86,208	55,016	33,677	81,301	88,000	75,737.3
Cost	56,699,244	72,477,450	57,414,528	36,640,656	22,428,882	54,146,466	58,608,000	50,441,032.3

2.9 Findings, conclusions and recommendations

(i) The whole spectrum of the container seaborne trade market acknowledges the importance of containerisation and the role played by the container in changing the face of the whole transport chain of dry freight cargoes. The whole world has reached a very advanced stage of containerisation;

(ii) There are 4.8 million containers in TEU in existence in the world and this figure is expected to exceed 5 million TEU by the end of 1987. Of these containers, 3.6 million TEU are standard units and the rest special units. 84.1 per cent are steel-cladded and 14 per cent aluminium and 1.9 per cent GRP. Therefore, maintenance and repairs carried out are mainly of steel equipment. Ownership of these containers is in the hands of the traditionally maritime nations of the world. Carriers and lessors in those regions control more than 97 per cent of the world container inventory leaving only 3 per cent to be shared between all "other" owners like shippers;

(iii) Container trade to and from the region can be described as medium/low as shown in Tables 13 and 18. The region makes up only 2.5 per cent of the total world throughput;

(iv) The port throughput for individual ports has generally been increasing. Four ports have now reached the 100,000 TEU and above. More are expected to reach this mark within the next few years;

(v) Container trade in Africa is highly imbalanced and fewer containers are used in the export leg of the trade route. This imbalance has cost the region a lot of money and foreign currency. For example, Nigeria loses an estimated $US 50.0 million, Cote d'Ivoire $US 13.6 million and Kenya $US 3.3 million per year through passed-on cost of transporting empty containers. This phenomenon also has adverse effects on the container maintenance and repair industry as container owners are unlikely to repair in areas of low export usage.

It is, therefore, time that the region should pay more attention to the container itself and investigate on a regional level the causes for the low container export usage, recommend solutions and thereafter take appropriate action, also at regional level.

CHAPTER III

CONTAINER MAINTENANCE AND REPAIR

3.1 Causes of container damage

Rapid containerisation has often entailed massive investment in ships, ports, rail facilities and highways, which is good. However, the integral part of the whole container operation, the container and its wellbeing has, in many cases, been overlooked. As discussed under Chapter II, the container itself and running it is an expensive affair. It is, therefore, time that the region took greater note of the containers. For purposes of maintenance and repair, not all "damage" constitutes damage necessitating remedial action by immediate maintenance or repair. The IICL Technical Committee's definition of damage is adopted here for this purpose as follows:

> "Damage (accidents/or otherwise) is any occurrence which does affect the structural integrity of the container design, dimensions (internal and external), water or certification requirements or which may endanger the safety of personnel, cargo or associated equipment or facilities".

The definition is broad enough to include rusting of the container to a certain degree like when left unattended at shippers' premises. It is also clear enough to exclude minor scratches and dents. Criteria for taking such decisions are suggested in the IICL guidelines. It is of great importance that the region and particularly those at container interchange points be acquainted with these guidelines.

In 1984, it was confirmed that by 1981 the world bill for container repair was about US$500 million per year. The significance of inviting the attention of the region to container damage at this time when the world repair bill ought to be much higher cannot be doubted considering that part of this bill may have been settled directly or indirectly by resources out of this region.

In the majority of cases, container owners know or have firm opinions on where in the transport chain damage occurs. Owners also know how much such damage is costing them. Most of them now reflect this item as a separate cost item in their voyage results.

There is wide agreement on the operational phases capable of inflicting damage to containers. The estimates of the contribution to the total damage incidences, however, differ not only between regions but also between the purpose of the estimates.

A study undertaken in 1976 for the coastguard stated that 45 per cent of all damaged containers is related to mishandling in port terminals (there were no inland container depots as we know then today), 30 per cent as related to damage on rail roads, highways and sea transport and 20 per cent due to improper stowage (Annex 1). In another study, it was found that where containers are transported on the hatch covers of a general cargo vessel 78 per cent of them were found to be damaged on arrival at destination (Annex 1).

Recently, a CP ship's records for its North Atlantic Container Service reported that 5 per cent of all container damage takes place at sea, 15 per cent while in transit rail or road trucks, 25 per cent directly to inadequate stowage practices and 45 per cent due to some aspects of port handling or inland terminal handling. This view was shared by many shipping lines operating on that route including ACC, APL and Lykes lines.

The position in this region is that the shipping lines consider 90 per cent damage to be between the port and the hinterland. They attribute 5 per cent to poor stowage and sea damage to be 5 per cent. It must be noted that, in fact, personal interview showed that many ship-owners strongly deny any container damage at sea. Representative of this attitude is the comment by the container repair manager of Bank line (Annex 1):

> "A shipping line can never damage a container because it never handles one."

It is true that shipping lines do not have a container handling role as such in the whole container transport chain. However, container damage does happen on board vessels for which they are responsible. Shipowners have been known even to be very difficult to assessors and insurers when such damage occurs (Annex 1):

> "Most of the major container lines are very responsive to consignees and shippers when damage (container and cargo) has occurred. Even so, one problem is that they can be very secretive. Many even refuse to tell us where the container was stowed in the ship".

This confirms that damage to containers at sea does occur. It was found out that relatively fewer damages occur on fully cellular vessels. Damage on board mostly happens when there is a twist or sliding of cell rails. At sea damage to containers occurs when a vessel rung aground or in heavy weather. Even so, it was observed that incidences of damage are more when containers are treated as break-bulk cargo in a conventional cargo hold or carried in bulk ships with fittings which are less common (vessels which are common in the West African trade). In such cases, there can be substantial movement in heavy weather, leading to damage and even to collapse of containers. Most damage resulting in containers being written off is from such kind of damage.

In heavy weather, containers can even be lost, despite progress made during the past 27 years in the development of lashing and securing systems for containers.

At sea, one other cause of damage highlighted by experts in the field is the very condition of transport whereby containers are subjected to motions due to the ship working in seaway. The forces acting on these containers are static and dynamic forces, static forces acting from gravitational forces acting on the container and its cargo. This force can be increased if lashings are overtensioned. Many problems cited causing container damage at sea in

heavy weather conditions, arise from the dynamic forces resulting from inert acceleration when the ship advances in the seaway in roll, pitch, heave, yaw, sway and surge. Each of these movements causes a specific type of container damage. The great majority of them is (i) racking. This is the deformation of the container end or side as result of static and dynamic forces parallel to the deck; (ii) toppling" is the tendency of containers to pivot on their bottom edge and eventually to overturn when subject to extreme rolling motions of the ship; (iii) container collapse: the corner post compression results from exceeding permissible loads on the container corner posts or vertical structure members (iv) local structural failure; is the separation of structural components of containers. The most common types involve separation of corner castings and end or side walls.

Also, it was mentioned that when containers are carried on ro-ro vessels damage occurs due to indiscipline by drivers driving containers in the vessels and this worsens depending on the design of the excess ramp which could be too steep.

The remaining 95 per cent of the damage takes place from the port to the hinterland. The proportions differ between trades. However, shipping lines particularly isolated the damage between the port and the hinterland to be the greatest cause of container damage in Africa.

Damage in the hinterland arises mainly out of mishandling of containers due to lack of proper handling equipment. Damage to the under floor structure is caused mainly by transporting the container on irregular surfaces of old road tracks; also by the storage of the equipment on surfaces not paved or not paved to proper specifications. Road truck drivers' behaviour on the roads was mentioned as the main reason for damage resulting from road accidents. Also narrow bridges, tunnels and low overbridges have been the other cause of many accidents whereby containers have fallen off the trucks. Many old and new trucks not made to specification have been found to have no proper locks leading to poor lashing also causing accidents.

In the port areas or ICD, damage mentioned by most experts was that related to stacking of containers; hence also discipline of drivers was mentioned. Movements aimed at stacking containers coupled with undisciplined forklift carrier drivers has resulted in damage. Roof holes, panel damage have all resulted from improper operation of forklift trucks or similar types of equipment. This is worse in congested container terminals. It was found out that rarely does damage in port areas arise during working from ship to shore or shore to ship.

3.2 Damaged container traffic in Africa

No specific statistics exist as to the exact number of containers damaged in a trade. However, the shipping lines and the port do often have some ideas of the magnitude of the problem.

Most shipowners spoke of damages to their own container fleet. For instance one major operator to East Africa gave figures that of 4450 units per year which went to Africa and returned to Europe, 3950 were repaired representing 90 per cent. OCC Container Limited found that 39 per cent of its containers utilised between developing regions is returned to the United Kingdom damaged. Such figures were many during the field mission but could not give a good basis for calculating the damaged fleet. In any case, the damaged fleet could differ from sub-region to sub-region and within the sub-region, port to port and line to line.

In West Africa, it was estimated by one shipping line, that in Abidjan, 2-5 per cent of all containers were damaged. It was also mentioned that for the port of Cotonou, 5 containers were damaged for every 20-50 containers sent there. These were the only indications as to the proportion of damaged containers in that sub-region.

In East Africa, those talked to about this question were very defensive. They did not give a convincing response worth quoting here. However, the expert view is that damage in that area could also be in the region of 5 per cent. Here is another area which requires thorough investigation by a well-considered research project.

3.3 Types of container damage

In the course of discussing causes of damage, types of damage have been indicated. There are many types of damage. They differ in seriousness and prevalence according to the trade.

In the region, the common types of damage are those falling under major indentations. The container is mishandled in such a way that damage occurs to door posts, rain gutters, doors, bottom end rails, topside rails, bottom rail fringe side and front panels, roof panels, roof bows, bottom cross member and fork pockets etc.

Also, excessively dirty containers were found. According to the definition, such dirty conditions of containers constitute damage. The position is that during the export of coffee, especially from East Africa, shippers line the interior of containers with paper fixed with adhesives; shipping lines find that on arrival this paper cannot be removed easily. So they have had to remove the units so affected from the service for "repair" to have the paper removed by professional cleaners which is an expensive exercise in Europe.

Then, there is the excessive rusting of containers. This happens when a container is delayed in the hinterland without being cared for. By the time it turns up at port, it is in such a horrible condition of rust that it has to be repaired.

At sea, it was the collapse of containers in heavy weather conditions which experts considered to be the main cause of damage to containers.

3.4 Current institutional arrangements for maintenance and repair

Containerisation International Yearbook 1987 indicates that a majority of maintenance and repair firms are located in developed countries. For Africa only two were mentioned in their survey. These are based in Mombasa. However, field missions revealed that there are so many small welding companies in that sub-region which accept repair of containers. In West Africa also, it was observed that there is one firm called Trans-Afric in Abidjan doing some repair work.

In both these sub-regions, there is a growing awareness of the need for container maintenance and repair services. During the mission, the Port Autonomi d'Abidjan indicated that there had been many requests by European shipowners for adjecent ports on which to establish their container maintenance and repair workshops. These requests had been turned down because the port was actively considering setting up its own container maintenance and repair workshop. They also indicated that they would consider putting the project in their next financial plan.

Sitram, the major national line for Cote d'Ivoire, also expressed interest in having its own container repair workshop.

In East Africa, one shipping line said that its subsidiary company Trans Ami is in the process of establishing a workshop to service and repair its own units.

Therefore, the market has recognized the need for container maintenance and repair. Conditions now are such that maintenance and repair work would be feasible.

Currently, most of the maintenance and repairs required by shipowners are done overseas. The existing repair works have been described by equipment owners as poor and sub-standard. One shipping line informed the mission that in fact the situation was bad that all repairs done in one African sub-region had had to be done again when the container reached Europe. The problem is that there is no order in the repairs being done now. They seem to assume that every welding and metal fabricating company can do container repairs. This is not true. In any case, repairs are being done overseas for many other reasons including (i) low export cargo conversion, (ii) lack of expertise, (iii) multiplicity of middlemen, (iv) economic repair costs.

3.4.1 Low export cargo conversion

The trade is highly imbalanced and fewer containers are used for export cargoes because of the existing low export cargo conversion. There is general agreement that repairs should be done as close as possible to the place of damage. This is not the case in this region. It is done where damaged if the unit is so damaged that it is difficult to lash it on rail or roadtrucks and where the owner sees a ready export use for the equipment. Otherwise, given the low quality of repair, time and cost of double repair, they prefer to take the units for repair abroad. There is a need for the region to address itself to causes and remedies for this low cargo convention and export usage.

3.4.2 Lack of expertise

During the mission, the existing repair works have been said to have poor supervision and to lack expertise. This has affected both the quality of repairs and time taken to do them. One of the most important facts that any repair workshop should control is the time the unit stays in the workshop because that time means revenue lost to its owner (Annex 1). Partly these delays depend on the extent of damage, the repair facilities available, the distance the containers have to be transported to the repair workshop and whether or not the container has to be unstuffed before the damage can be repaired.

The skills needed by workers to repair dry cargo steel containers are many (Annex 1). Some of the more important ones are experience with metal working hard tools, bending and cutting sheet metal, gas, electric and inert gas welding systems, and familiarity with the use of blueprints and wiring diagrams. Furthermore, repair works are usually assisted by specialists such as an electrician to service appropriate systems for tools, trailers, forklifts, etc., a maintenance man to service mechanical tools, engines, etc., a man to issue, store and order needed spare parts, an inspector to review containers upon arrival for damage and complete equipment interchange and damage reports, a foreman to schedule, inspect and approve repair works, and a carpenter to replace damaged flooring. Many of these skills can be combined. To obtain these skills is not the problem but to get top men who are completely oriented to container repair works and aware of existing requirements for repairs according to the conventions like ISO, the CSC, customs (TIR) and the repair guidelines by IICL etc. This is where the repair facilities in existence are weakest. Also, the output is very low, the highest quoted was 10 units per week which means 100 units from different owners would take about 3 months. No reasonable owner can wait that long for the repair of his equipment.

The man to inspect the unit and give report of damage and estimate of cost of repair is particularly crucial. His work can either build or ruin the performance of a repair firm. He can overestimate in which case he can lose the customer immediately or subsequently. He could underestimate in which case his firm would suffer loss in profitability. The lack of of supervisors referred to by shipowners was both in terms of quality of work produced, delays and outrageous price quotations.

There is certainly a need for the main men like the workshop supervisors, inspectors to be trained either by attachments to existing workshops in developed countries or by regional workshops/seminars/or special courses.

3.4.3 Multiplicity of middlemen

The behaviour of the many middlemen was said to be a problem. Many shipping agents could go to a repair shop, and put forward their estimate for repair which could be very low instead of the other way round. In many cases, after negotiations, a level acceptable by this agent and the workshop could be reached. After repair is done, the agent would pay the workshop accordingly. However, this agent could go away and raise his own highly inflated bill for the foreign container owner to settle. Thereafter, the container owner would not even consider repairing his units in this region. He gets the wrong impression altogether. This practice led to a dry docking company, African Marine General Engineering, based in Mombasa, to suspend accepting containers for repair. This company, with all the required equipment used for ship repair and service which could be redeployed to container repair, advised that for the industry to thrive, owners of units should make direct negotiations with repair shops. It was confirmed that none of those currently doing repair work in that area now knew anything about the relevant shipping safety standards, TIR customs requirements and the generally acceptable standards for container repairs.

3.4.4 Economic repair costs

Traditionally most container operators tend to underestimate the level of maintenance and repair expenditure in their budgets. The forecasting of maintenance is perhaps easier to predict since where the refurbishing of containers or routine preventive servicing of chassis are concerned, these could be undertaken on a pre-programmed used basis. The steel unit refurbishment takes place every 4-5 years depending on the trade route, whilst aluminium containers are processed every 6 to 7 years. These repair costs are often re-capitalised over the extended life of the equipment.

The situation for repair to the containers due to damage is different. Apart from cargo considerations, delays, etc the financial position of the owner is crucial. He has to make a decision on the economic repair cost, whether or not it would be feasible to effect the repair. Many owners have technical staff as "container repair" managers or "equipment" managers to look after the units and to take these repair decisions. Various factors are considered but as "a rule of thumb" they use the following formula (Annex 1)

$$\text{Economic repair cost} = n\,\frac{(R+D)}{X} + B + L - S - C$$

Where:
P = Replacement cost of similar equipment
n = Remaining lifespan of the equipment so damaged
X = Effective lifespan of unit
B = Book value of temporary replacement equipment
L = Leasing costs of temporary replacement equipment
D = Crucial differential in repair costs between old and new equipment, over the residual of damaged unit
S = Resale or scrap value of damaged unit
C = Third party recovery

One aspect which the region could improve on is the third party recovery. The person responsible for damage within the transport chain is currently not in difficulty because of the poor interchange system. Equipment interchange receipts (EIR) are not properly conducted, thereby reducing the possibility of third party recovery. Probably, this explains the attitude of unit owners sending old units to developing countries trade routes.

There is a need in this region to evaluate the type of personnel entrusted with the task of preparing the EIR where necessary ways could be proposed to improve their work output.

3.5 Locations for container maintenance and repair

The existing container maintenance and repair works are located with a reasonable distance from the port areas. In West Africa, Trans Afric is very close to the port. Owing to space problems behind the port of Mombasa, the firms which accept repairs are outside the port area but within the town's industrial area. This is permissible.

There are many factors which should be considered before an area or port city or town is considered for establishment of container maintenance and repair firms some of which are (Annex 1) (i) low wages, (ii) low taxes, (iii) availability of spare parts, (iv) favourable conditions for investment, like stable political, economic and labour situations, (v) low transport costs to repair facilities (vi) container flows, (vii) high export usage. Most of these criteria would have to be considered in all cases. Therefore, they would not help to pinpoint suitable locations for the region. The last two (vi) and (vii) were found to be the most important for the region for assisting in choice of the locations. They have been discussed in the foregoing chapters.

According to container flow, the major ports with 100,000 TEU would have been the only ones to be considered. However, when the second criteria of high export usage is appliedit was found that the large ports, Lagos/Apapa and Alexandria do not qualify. Lagos/Apapa, 1985, updated, loaded 78,162 TEU and 96 TEU empty, exported loaded 5,750 TEU but shipped empty 88,000 TEU showing a very low export container usage. Alexandria, 1985, loaded import 68,000 TEU, empty import 232 TEU, loaded export 14,915 TEU, empty export 51,160 TEU also showing very low export usage. Unit owners are more concerned with repositioning their units than repair in these areas because there is no cargo incentive. So their preoccupation would be to take their containers away from these areas as expeditiously as possible to high export usage areas, unless the unit is so damaged that it cannot be lashed or would be a risk to safety on board. The high export usage ports could receive the empty units and serve as re-positioning points. These are the areas of high repair and maintenance demand. This leaves three major ports, Abidjan, Mombasa and Douala and one other port, Djibouti, whose position within the Red Sea has no better competitor.

It was also found out that some port areas have very important maritime projects being planned of under way in their hinterlands. So it is expected that container flow and export usage would increase in these areas in the near future. These ports are Dakar, Matadi and Maputo or Beira. Also, the effect of the inland terminals, dry ports had to be considered. Therefore, three areas were recognised during the study; (a) areas of immediate need (b) areas of potential high cargo flow and export usage (c) the inland container terminals of landlocked countries.

The areas of immediate need are:

(i) Abidjan
(ii) Mombasa
(iii) Douala
(iv) Djibouti

These areas would present the best location given the existing situation.

The areas of future need depending on maritime development in those ports and their hinterland are:

(i) Dakar
(ii) Matadi
(iii) Maputo and Beira

For this group conditions should be reviewed, in 2-3 years. In these two categories, it is the expert's view that container repair would be feasible.

The countries with inland terminals or landlocked countries with dry ports should also be under constant review as they may soon need such services.

The position of the North African sub-region is in a different category altogether. The trade pattern in that sub-region is directly vertical to the European ports of the Mediterranean Sea. These ports have low container flow and low export usage of containers. Also, the repair services in European ports are very near and would present strong competition. That sub-region should be reviewed again after 2-3 years.

3.6 Physical plant and other operational considerations

There are aspects of the container maintenance and repair which also ought to be considered by sub-region in setting these workshops. These are the basic conditions required for successful operations. Adopting the experience of the study made in the ECLA region the main cosiderations could be categorised as (i) physical plant, (ii) equipment and spare parts, (iii) mobile repair units, (iv) specific operations like container inspection, documentation, surface preparation and painting, (v) container markings (vi) work productivity

programmes, and (vii) cost control and profitability. These are reproduced as an Annex for information to anyone who may wish to set up a maintenance and repair unit. Also, the experience of ECLA, though they have different operational movements, could be useful and it is suggested that any interested party should acquaint himself with it (Annex 6).

In this region the operating environment is different and it is necessary that the situation in the region be studied carefully for the benefit of any interested parties, like governments, port authorities and private investors.

3.7 Findings and recommendations

(i) The region has certainly made headway in providing facilities for containerisation like ports, rail and road trucks and internal container terminals, etc. Very little, if any, provision has been made for facilities centred on the container itself and in particular its maintenance and repair. Given that US$500 million world bill for container repairs has been confirmed for the yar 1981, much higher now, it is time for the region to take a greater interest in the container itself and particularly its maintenance and repair;

(ii) Containers are damaged during the whole process of transportation. During its sea voyage, in port handling and stacking yards, during its transiting journey into the hinterland by rail and road trucks and through handling operations in the hinterland. About 95 per cent of the damage in the region happens in the port and hinterland sector, the largest blame being on the hinterland portion of the journey. The most common types of damage are indentations to the container panels, damage to the bottom side rails and cross members, side posts, roof bow, top rails and door;

(iii) The region has a few workshops accepting container repairs. However, their performance is condemned as being poor and sub-standard by the shipowners who also happen to be the equipment owners. Most of the repairs and maintenance are done overseas. This is because of low cargo conversion to containerisation and hence low export cargo use of containers, lack of expertise, multiplicity of middlemen and economic repair cost considerations;

(iv) A definite need for repair and maintenance facilities was observed and even the market itself is at the moment trying to do something about it though in an unsatisfactory way. It would appear that it would now be feasible to establish container maintenance repair plants in the region;

(v) Proposals for appropriate locations are influenced mainly by the container flow and level of export cargo usage. Based on this criteria and the major maritime activities, it is suggested that the port authorities in the areas of immediate need like Abidjan, Mombasa, Douala and Djibouti should be encouraged and assisted to provde maintenance and repair facilities. In the areas of future need like Dakar, Matadi, Maputo or Beira, their position should be reviewed after 2-3 years. The same is proposed for North Africa;

(vi) The need has also been observed for a careful and thorough study of the container repair and maintenance operational environment to provide assistance to government, port authorities and other interested parties who may want to consider providing these facilities.

ANNEX I

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ANNEX II

Comparative costs of new ships - West Africa- North West Europe

(excluding port, cargo handling and other shore costs)

	Multi-Purpose		Fully cellular	Ro-ro container
DWT	16,500	22,000	28,000	24,000
TEU	500	800	1,350	1,150
of which on deck	250	370	400	350
Cargo capacity-m^3				
Bale	22,000	29,000	-	(44,000)
Containers	8,000+	11,840+	43,200	36,800
Total	30,000	40,840	43,200	36,800
Capacity per voyage- m^3				
-Holds	30,800	40,600	-	-
Containers	14,400+	21,312+	77,760	66,240*
Total	45,200	61,912	77,760	66,240
Fuel Consumption:				
-at sea (tons/day)	30	50	70	50
-in port (tons/day)	7	10	12	10
Diesel consumption (tons/day)	2	2	3	3
No. of port calls:				
West Africa	4	3	7	5
NW Europe	4	4	6	8
Days in port:				
West Africa	14	14	11	6
NW Europe	13	13	6	7
Total port time	27	27	17	13
Days at sea	29	29	32	25
Days per round voyage	56	56	49	38
Daily operating costs (US$):				
Capital	6,062	7,492	11,483	18,975
Other costs	4,544	5,238	6,632	-
Costs per voyage (US$):				
Capital	339,472	419,552	562,667	721,050
Container hire	210,000	336,000	496,125	327,750
Other operating costs	254,464	293,328	324,968	259,388
Bunkers	240,410	366,000	516,810	302,100
Total	1,044,346	1,414,880	1,899,570	1,610,288

	Multi-Purpose		Fully cellular	Ro-ro container
Costs per m^3 of capacity (US$):				
Capital	7.51	6.78	7.24	10.89
Container hire	4.65	5.43	6.38	4.95
Other operating costs	5.63	4.71	4.18	3.92
Other operating costs	5.32	5.91	6.63	4.56
Total	23.11	22.85	24.43	24.31
Sensitivity to changes in assumptions:				
Broken stowage 40% in holds	25.60	25.22	24.43	24.31
10% increase in fuel costs	26.19	25.87	25.09	24.77

+ deck containers only * assuming a full load of containers

Source: The Lambert Brothers Report page 12

ANNEX III

Description of container types

General Cargo container: This is a general term applicable to any type of container not intended for use in air transport and which is not primarily intended for transport of a particular type of cargo: a cargo requiring temperature control, a liquid or gas cargo, dry solids in bulk, or cargoes such as automobiles (cars) or livestock.

General purpose container: Freight container, totally enclosed and weatherproof, with a rigid roof, rigid side-walls, rigid end-walls and a floor, at least one of the end-walls equipped with doors and intended for the widest variety of cargoes. A general purpose container having an opening roof may be used for the same specific purpose as an open-top container.

Specific purpose container: This is a general term applicable to all general cargo containers having constructional features either for the "specific purpose" of facilitating packing and emptying other than by means of doors at one end of the container, or for other specific purposes such as ventilation.

Closed ventilated container: General purpose container with provision for the specific purpose of either natural or forced ventilation; otherwise similar to a general purpose container.

Open-top container: Freight container similar in all respects to a general purpose container except that it has no rigid roof but may have a flexible and movable cover: for example, one made of canvas or plastic or reinforced plastic material normally supported on movable or removable roof bows.

Such containers may have movable or removable tops and transverse members above their end-doors.

Platform-based container (open-sided): This a general term applied to any general cargo container which does not have rigid side-walls or equivalent structures capable of resisting all loads that may be withstood or transmitted by a side-wall of a general purpose container which, for this reason, has a base structure similar to that of a platform (container).

Platform-based container (open-sided): with complete superstructure: Platform-based container, having a permanently fixed longitudinal loadcarrying structure between ends at the top. (The term "load" as used refers to a static/dynamic type load, not a cargo load).

Platform-based container (open-sided) with complete superstructure and fixed ends: platform-based container without permanently fixed longitudinal loadcarrying structure between ends, other than at the base.

Platform-based container with incomplete superstructure and folding ends: platform-based container with incomplete super-structure, but with folded end frames with a complete transverse structural connection between corner posts.

Platform-container: Loadable platform having no superstructure whatever, but having the same length and width as the base of a container of the same series and equipped with top and bottom corner fittings, located in the plan view as on those containers so that some of the same lashing and lifting devices can be used.

Specific cargo containers: This is a general term applied to those types of container which are primarily intended for the carriage of particular categories of cargo. The term is applied to those types of container defined in the following paragraphs.

Thermal container: Freight container built with insulating walls, doors, floor and roof which retard the rate of heat transmission between the inside and the outside of the container.

Insulated container: Thermal container without the use of devices for cooling and/or heating.

Refrigerated container (expendable refrigerant): Thermal container using a means of cooling such as:

- ice, or
- dry ice, with or without sublimation control, or
- liquefied gases, with or without evaporation control. It is implicit in this definition that such a container requires no external power or fuel supply.

Mechanically refrigerated container: Thermal container served by refrigerating appliance (mechanical compressor unit, absorption unit, etc.)

Heated container: Thermal container served by heat-producing appliance.

Refrigerated and heated container: Thermal container served by refrigerating appliance (mechanical or expendable refrigerant) and heat-producing appliance.

Tank container: A freight container which includes two basic elements, the tank or tanks and the framework, and complies with ISO requirements.

Dry bulk containers: Container consisting of a cargo-carrying structure, firmly secured within an ISO framework, for the carriage of dry solids in bulk without packaging.

Named cargo types: Various types of container such as automobile (car) containers, livestock containers and others, are built in general in accordance with ISO container requirements, either solely or primarily for the carriage of a named cargo.

Source: Seminar on Container Terminal Management - Antwerp UNCTAD/SHIP/512

ANNEX IV

(With Attachments)

Pictorial examples of typical containers and dimensions

Basic Design of Steel Container

A steel container is usually constructed of corrugated and fabricated steel. The front (blind) end and side walls and steel roof sheets are either flat or corrugated sheets. The top and bottom rails and end frames are fabricated of steel.

The container may be 20, 30 or 40 feet long by 8 feet wide by 8, 8 1/2, 9 or 9 1/2 feet high. It may or many not include lining. The 40 foot long container normally has no fork lift pockets while the 20 and 30 foot long containers often have fork lift pockets.

The container frame consists of steel corner fittings (castings) at all eight corners, which are usually fastened by welding to the corner posts, top and bottom side and fron rails, and rear door sill and header.

Floor cross members are usually of steel C, Z or I beam sections attached to the bottom rail, usually by welding.

Roof bows which support the flat roof are of steel, attached by welding to the top rails.

Doors are usually of steel or plymetal (steel faced) panel with steel locking hardware. Steel hinges are often plastic lined. Flexible plastic or synthetic rubber is used to seal the door assembly against water leakage.

The roof is a flat steel sheet and may be bonded or welded to roof bows and welded to the top rails and door header. It may also be an integral preseed (corrugated) section without roof bow and entirely welded to the top rails and door header.

The floor may be of hard or soft laminated wood, plaks or plywood or a combination of wood and metal sections.

Basic Design of Aluminium Container (See Figure 2)

An aluminium container, sometimes called an aluminium/steel container, usually has steel end frames, aluminium or steel side rails and aluminium sides and front walls. The dimensions and many details are similar to those of the steel container.

Side and front posts are of aluminium and bolted or riveted to the top and bottom rails along the front and sides. Posts may be outside or inside the aluminium sheet siding.

Aluminium panels are riveted to the side and front posts, the top and bottom rails.

Roof bows, which support the roof, are usually of aluminium extrusions attached by bolting, riveting or welding to the top rails.

Floor cross members are of steel or aluminium attached to the bottom rail by bolts, rivets or welding.

The inside walls are usually lined with plywood sheets riveted to the aluminium siding at the posts.

Plymetal doors usually have an aluminium or galvanized steel outer facing.

Source: IICL Guidelines.

Unit load data

(a) ISO freight containers

The data given below is extracted from the International Organization for Standardization (ISO) standards 668:1979 (Freight containers – external dimensions and ratings) and 1496/1:1984 (Series 1 freight containers – Specification and testing – Part 1: General cargo containers for general purposes) and is reproduced by permission. Copies of ISO 668 and ISO 1496/1 are available from national standards organizations or direct from International Organization for Standardization, 1 rue de Varembé, PO Box 56, CH-1211 Geneva 20, Switzerland. *Tel:* (22) 34 12 40 *Fax:* (22) 33 34 30 *Telex:* 23887

TABLE 1 – Nominal dimensions of series 1 freight containers

Freight container designation	*Height*			*Width*		*Nominal length**	
	mm	ft	in	mm	ft	mm*	ft
1A	2 438	8		2 438	8	12 000**	40**
1AA	2 591***	8	6***	2 438	8	12 000**	40**
1B	2 438	8		2 438	8	9 000	30
1BB	2 591***	8	6***	2 438	8	9 000	30
1C	2 438	8		2 438	8	6 000	20
1CC	2 591***	8	6***	2 438	8	6 000	20
1D	2 438	8		2 438	8	3 000	10

* The exact lengths are shown in Table 2.
** In certain countries there are legal limitations to the overall length of vehicle and load.
*** In certain countries there are legal limitations to the overall height of vehicle and load.

TABLE 2 – Dimensions and tolerances for series 1 freight containers

Freight container designation	*Length (external)*			*R*			*P*			R_1 max		R_2 max	
	mm	ft	in	mm	ft	in	mm	ft	in	mm	in	mm	in
1A 1AA	12 192 $^{0}_{-10}$	40	0 $^{0}_{-\frac{3}{8}}$	11 985	39	$4\frac{1}{8}$	2 259	7	$4\frac{11}{16}$	19	$\frac{3}{4}$	10	$\frac{3}{8}$
1B 1BB	9 125 $^{0}_{-10}$	29	$11\frac{1}{4}$ $^{0}_{-\frac{3}{8}}$	8 918	29	$3\frac{1}{8}$	2 259	7	$4\frac{11}{16}$	16	$\frac{5}{8}$	10	$\frac{3}{8}$
1C 1CC	6 058 $^{0}_{-10}$	19	$10\frac{1}{2}$ $^{0}_{-\frac{3}{8}}$	5 853	19	$2\frac{1}{16}$	2 259	7	$4\frac{11}{16}$	13	$\frac{1}{2}$	10	$\frac{3}{8}$
1D	2 991 $^{0}_{-10}$	9	$9\frac{3}{4}$ $^{0}_{-\frac{3}{8}}$	2 787	9	$1\frac{49}{64}$	2 259	7	$4\frac{11}{16}$	10	$\frac{3}{8}$	10	$\frac{3}{8}$

R_1 = Difference between diagonals, measured from centres of apertures in corner fittings, on top surface.
R_2 = Difference between diagonals, measured from points on the endwall/roof and endwall/floor junctions perpendicular to centres of apertures in corner fittings in endwalls.
S = Length between centres of apertures in corner fittings.
P = Width between centres of apertures in corner fittings.
Width (external) – Containers 1A, 1AA, 1B, 1BB, 1C, 1CC, 1D: 2 438 $^{0}_{-5}$ mm (8ft 0 $^{0}_{-\frac{3}{16}}$ in).
Height (external) – Containers 1A, 1B, 1C, 1D: 2 438 $^{0}_{-5}$ mm (8ft 0 $^{0}_{-\frac{3}{16}}$ in).
Height (external) – Containers 1AA, 1BB, 1CC: 2 591 $^{0}_{-5}$ mm (8ft 6in $^{0}_{-\frac{3}{16}}$ in).

TABLE 3 – Minimum internal dimensions – series 1 freight containers – general purpose containers

Freight container designation	*Minimum height*	*Minimum width*		*Minimum length*		
		mm	in	mm	ft	in
1A	Nominal container external height minus 241mm (9$\frac{1}{2}$in)	2 330	$91\frac{3}{4}$	11 998	39	$4\frac{3}{8}$
1AA				11 998	39	$4\frac{3}{8}$
1B				8 931	29	$3\frac{1}{2}$
1BB				8 931	29	$3\frac{1}{2}$
1C				5 867	19	3
1CC				5 867	19	3
1D				2 802	9	$2\frac{3}{4}$

The dimensions apply when measured at a temperature of 20°C (68°F). Measurements taken at other temperatures should be adjusted accordingly. Where a top corner fitting projects into the internal space specified by the table, that part of the corner fitting projecting into the container should not be considered as reducing the size of the container.

Container certification

Certification requirements fall into several categories: those relating to transport of goods under customs control, those relating to certification for the purpose of protecting foodstuffs and other products, and those relating to safety in handling.

These categories can be interpreted as follows:—

1. Customs control

Customs approval – international transport

To be approved for the international transport of goods under customs seal containers must meet the technical requirements of either:—

(a) The Customs Convention on the International Transport of Goods under cover of TIR Carnets (TIR Convention); or

(b) The Customs Convention on Containers.

To meet these requirements containers must be constructed and equipped in such a manner that:

(a) No goods can be removed from, or introduced into, the sealed part of the container without leaving visible traces of tampering or without breaking the customs seal.

(b) Customs seals can be simply and effectively affixed to them.

(c) They contain no concealed spaces where goods may be hidden.

(d) All spaces capable of holding goods are readily accessible for Customs inspection.

The Conventions are designed to enable goods to be carried under customs seal in secure containers constructed in accordance with the requirements of the Conventions with the minimum of customs control in transit. These measures simplify the task of customs authorities and at the same time speed the passage of containerised traffic.

In the UK, approval of a container for the international transport of goods under customs seal can be granted only by a competent authority acting on behalf of HM Customs & Excise. The certifying organisations listed below have been recognised by HM Customs & Excise for the approval of all new containers and applications are made directly to them.

Ajax Insurance Association Ltd
Ajax House, Haslemere Rd
Liphook, Hants

American Bureau of Shipping
1 Frying Pan Alley
London E1 7HR
Tel: (1)247-3255 *Telex*: 885621, 8811205

Associated Offices Technical Committee
82 St Mary's Parsonage
Manchester M60 9AP

Bureau Veritas
Ocean House, 24–25 Great Tower St
London EC3R 5AQ
Tel: (1)623-1665 *Fax*: (1)626-5854
Telex: 886201

Cornhill Insurance Co Ltd
Special Service Divn
PO Box 10, 57 Ladymead
Guildford, Surrey GU1 1DB

Eagle Star Group Engineering Insurance Ltd
54 Hagley Rd
Edgbaston, Birmingham B16 8QP

International Shipping Trustees (UK) Ltd
Fitzwilliam House, Skimped Hill
Bracknell, Berks RG12 1HT

Lloyd's Register Industrial Services
Norfolk House, Wellesley Rd
Croydon, Surrey CR9 2DT
Tel: (1)686-2455 *Fax*: (1)681-8146
Telex: 29636

Application for the customs approval of containers which have been in service, or their re-approval if applicable, must be made to one of the certifying organisations listed above.

Department of Transport publication VE 505 is based on the technical annexes of the Customs Conventions and lays down the conditions of approval of vehicles and containers for the transport of goods under customs seal.

The Customs Convention on Containers sets out basic standards of security to be met by containers intended for the international transport of goods under customs seal. Containers which meet these requirements and are so approved by the competent authorities must be accepted by all parties to the Convention. The standards prescribed are kept under regular international review to take account of technical and other developments.

Disposal of old or badly damaged temporarily imported foreign-owned containers

Importers must notify HM Customs & Excise to account for duty and VAT when temporarily imported foreign-owned containers are sold or otherwise disposed of in the UK. The conditions which are set out in Customs Notice No 309, paragraph 22, must be complied with in all cases. Importers must also notify the local Customs & Excise office when they intend to sell or destroy containers. Notification is required whether the containers were entered on Form C144A or under the "no documentation undertaking procedure".

In both instances, under the terms of the undertaking given at the time of importation, duty and VAT must be accounted for at the time of the sale or on the value of any resulting scrap. As the undertaking is legally binding upon the importer and not a third party it is not acceptable for the purchaser to account for the duty and VAT. Non-compliance with the conditions set out in Notice No 309 may result in the withdrawal of the undertaking facility.

2. Certification for the purpose of protecting foodstuffs and other products

Commodities of the above types may become damaged or contaminated by infestations. National requirements can require those concerned in the manufacture, storage and transport of food to take action to prevent damage as above. Certain pests are listed under quarantine regulations as prohibited in some countries and to avoid the problems that can arise due to infestation in freight containers or their contents the design of containers should be such as to prevent introduced pests becoming established and also to enable the containers to be thoroughly cleaned and disinfested after use.

The Agreement on the International Carriage of Perishable Foodstuffs (ATP) lays down standards to ensure that equipment is capable of maintaining the required temperature to preserve the quality of foodstuffs in transit. The Agreement does not apply to sea journeys other than those of less than 150km forming part of an international land journey. It provides for the testing and certification of equipment, which includes containers, as complying with the standards laid down. In the UK, Lloyd's Register Industrial Services has been appointed as the certifying body for the purpose.

The following countries are contracting parties to the Agreement: Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, Finland, France, East Germany, West Germany, Italy, Luxembourg, Morocco, Netherlands, Norway, Poland, Spain, Sweden, UK, USA, USSR, Yugoslavia.

Contracting parties agree to recognise certificates of compliance issued by other contracting parties for equipment registered or recorded in their territory and may recognise those of non-contracting states.

3. Construction and testing

International aspects

The international operation of containers makes it essential that certification is also internationally acceptable. The adoption of ISO requirements for construction and safety testing is in operation internationally and containers manufactured to ISO requirements are universally accepted.

Classification societies and certifying organisations operate on a worldwide basis and are therefore able to ensure compliance with a uniform standard of construction and testing.

These requirements are specifically laid down in ISO, national and certifying organisational schemes. The implementation of these requirements is considered in some detail in the section on the International Convention for Safe Containers (CSC) which follows later in this chapter. Compliance ensures that passage of an approved container will not be impeded whilst investigations are made as to the suitability of the item concerned. If the ISO code is taken as a standard then the following table gives sizes and ratings:

ISO Designation	*Length*	*Width*	*Height*	*Rating (MGW)*
1A	40ft	8ft	8ft	30 tons
1AA	40ft	8ft	8ft6in	30 tons
1B	30ft	8ft	8ft	25 tons
1BB	30ft	8ft	8ft6in	25 tons
1C	20ft	8ft	8ft	20 tons
1CC	20ft	8ft	8ft6in	20 tons
1D	10ft	8ft	8ft	10 tons

Within the framework provided in the table above, containers of the following types can be manufactured:

1. General cargo, as follows:—
   (a) closed
   (b) open top
   (c) open side
   (d) open top, open side
   (e) open top, open side, open end
2. Thermal containers as follows:—
   (a) refrigerated
   (b) insulated
   (c) heated
3. Tank containers for:—
   (a) bulk liquids
   (b) compressed gases
4. Bulk containers for the carriage of powders
5. Platform containers
6. Platform-based containers with:—
   (a) incomplete superstructure and fixed ends
   (b) incomplete superstructure and folding ends
   (c) complete superstructure and open sides

The tests to which ISO-type containers are subjected ensure that the units comply with the requirements in all respects and such units are clearly marked by the certifying organisation in accordance with such requirements. This identification permits the definition at any time of the constructional requirements under which the container was manufactured.

Type approval involves design appraisal, together with construction and test of a prototype. Type approval extends to containers of the same design built in a similar manner under survey either on an individual basis or under a series production system.

4. Safety in handling

The International Convention

The International Convention for Safe Containers (CSC) was adopted by a Conference on International Container Traffic held in Geneva in December 1972 under the auspices of the UN/IMO. The Conference produced an agreement which requires all containers to be type tested, approved and subsequently examined throughout their working life. Under this agreement, all containers, ISO and non-ISO, are required to carry a Safety Approval Plate. No container can carry such a plate unless it has been approved.

The CSC came into force on September 6, 1977, twelve months after the deposit of the tenth instrument of Ratification.

The difficulties involved in approving and plating the huge number of containers in existence before the entry into force of the Convention was recognised when the Convention was adopted in 1972. Transitional approval arrangements were written into the Convention as well as a grace period of five years during which owners of existing containers could apply for approval, ending September 6, 1982. The deadline for plating of all containers expired on January 1, 1985. A further transitional period (to January 1, 1987) was allowed for marking the date of the next examination on the CSC plate. This was done to allow owners a reasonable degree of flexibility in planning the examination of containers and to even out the workload. In the UK the Freight Containers (Safety Convention) Regulations 1984 took effect on January 1, 1985. On the same date the contracting authorities worldwide began checking containers to ensure that they carried a CSC Safety Approval Plate.

Regulation 2 of the Annex to the Convention is concerned with maintenance and examination and requires that, once a container has been approved, it shall be examined in accordance with a procedure either prescribed or approved by the Contracting Party.

There are two alternatives. The first is a Periodic Examination Scheme (PES). It requires that the date before which a container should next be examined should be marked on, or as close as practicable, to the Safety Approval Plate. The interval from the date of manufacture of a new container to the date of the first examination must not exceed five years. Subsequent examinations of new containers and examinations of existing containers should be at intervals not exceeding 30 months.

The second alternative is for an Approved Continuous Examination Programme (ACEP). This can be followed if the Contracting Party agrees to give such approval. Examinations performed under such a programme would be in connection with a major repair, refurbishment, or on-hire/off-hire interchange and would occur not less than once every 30 months. To indicate that the container is operated under an approved continuation programme, a decal should be displayed on the container on, or as close as practicable, to the Safety Approval Plate. This decal will show the letters "ACEP" followed by the identity of the country giving the approval. Some administrations will also require an approval number. The preferred colour for the decal is for black letters on a white background.

As a transitional provision, the enforcement of the requirement for marking on containers the date of the first examination of new containers, the re-examination of new containers not approved at the time of manufacture, the re-examination of existing containers and any containers operated under an approved continuation programme was waived until January 1, 1987.

Administrations could, at their discretion, allow owners of containers plated before January 1, 1985 to mark the date of the next examination as follows:

Date of initial plating	*Latest date for re-examination*
Existing containers, and new containers not approved at time of manufacture, plated before Oct 1, 1981. New containers plated before 1979	December 1985
Existing containers, and new containers not approved at time of manufacture, plated from Oct 1, 1981 to Sept 30, 1982. New containers plated in 1979	April 1986
Existing containers, and new containers not approved at time of manufacture, plated from Oct 1, 1982 to Sept 30, 1983. New containers plated in 1980	August 1986
Existing containers, and new containers not approved at time of manufacture, plated from Oct 1, 1983 to Dec 31, 1984. New containers plated in 1981	December 1986

Contracting parties

Currently, the contracting states (in various stages of entry) are: Argentina, Australia, Bahamas, Barbados, Belgium, Benin, Bulgaria, Byelorussian SSR, Canada, Chile, PRC, Cuba, Czechoslovakia, Denmark, France, East Germany, West Germany, Republic of Guinea, Honduras, Hungary, India, Israel, Italy, Japan, Liberia, Luxembourg, Netherlands, New Zealand, Norway, Pakistan, Poland, Portugal, Romania, Saudi Arabia, South Africa, South Korea, Spain, Sweden, Ukrainian SSR, UK, USA, USSR, South Yemen.

Implementation of CSC

Pending the worldwide ratification of the Convention, it has not been possible to obtain a complete listing of responsible national authorities but information so far available is given below:

Argentina Comando en Jefe de la Armada, Secretaria General Naval, Departamento Intereses Maritimos, Calle Comodoro Py y Corbeta Uruguay, Buenos Aires.

Australia First Assistant Secretary, Maritime Safety Division, Department of Transport, PO Box 594, Canberra, ACT 2601.

Bulgaria Ministry of Transport, Levski Str 9/11, BG-1000 Sofia.

Canada Board of Steamship Inspection of the Canadian Coast Guard.

Chile Direccion General del Territorio, Maritimo y de Marina Mercante, Errazuriz 537, Correo Naval, Valparaiso.

Denmark Danish Directorate for Labour Inspection Service, Landskronagade 33-35, DK-2100 Copenhagen O.

France M le Chef du Bureau des Conteneurs, 44 Rue de Rome, F-75008 Paris.

East Germany DDR-Schiffs-Revision und -Klassifikation (DSRK), Eichenalle 12, DDR-1615 Zeuthen bei Berlin.

West Germany Bundesminister fur Verkehr, Postfach 100, D-5300 Bonn 2.

Greece Ministry of Mercantile Marine, Merchant Ships Inspection Service, 1 Paleologou St, Piraeus.

Hungary The Shipping Authority, Shipping Dept, Ministry of Transport and Telecommunications, Apaczai Csere Janos utca 11, H-1052 Budapest.

Japan Maritime Technology & Safety Bureau, Ministry of Transport, 2-1-3, Kasumigaseki, Chiyoda-ku, Tokyo.

Netherlands Directorate-General, Shipping & Maritime Affairs, Bordewijkstraat 4, Postbus 5817, NL-2280 HV Rijswijk.

Romania Registrul Naval Roman, Sector 7, Bd. Dimtou Golescu 38, Bucharest.

South Korea Inspection & Measurement Div., Korea Maritime & Port Administration, 263 Yeonji Dong, Jongro Ku, Seoul 11000.

Sweden National Swedish Administration of Shipping & Navigation, S-60178 Norrkoping.

UK Health & Safety Executive (Safety Policy Branch A), Baynards House, 1 Chepstow Place, London W2 4TF (for England, Scotland and Wales); Dept of Economic Development, Maryfield, 100 Belfast Rd, Holywood, Co Down, Northern Ireland BT18 9QX (for Northern Ireland).

USA USC oast Guard (G-MVI-2), 2100 Second St SW, Washington, DC 20593.

Additionally, reference could usefully be made to major organisations engaged in work of this type and possessing extensive networks of offices worldwide who have formulated certification schemes.

These include:

American Bureau of Shipping
45 Eisenhower Drive
Paramus, NJ 07652, USA
Tel: (201) 368-9100 *Fax*: (201) 368-0255
Telex: 421966, 232099, 620353

Bureau Veritas
17 bis, Place des Reflets, La Defense 2
F-92400 Courbevoie, France
Tel: (1) 42 91 52 91 *Fax*: (1) 42 91 52 97
Telex: 611135

Germanischer Lloyd AG
Vorsetzen 32, Postfach 111606
D-2000 Hamburg 11, West Germany
Tel: (40) 36 14 90 *Fax*: (40) 36 14 92 00
Telex: 212828

Lloyd's Register Industrial Services
Norfolk House, Wellesley Rd
Croydon CR9 2DT, UK
Tel: (1) 686-2455 *Fax*: (1) 681-8146
Telex: 28636

Nippon Kaiji Kyokai
4-7, Kioi-cho
Chiyoda-Ku, Tokyo 102, Japan
Tel: (3) 230-1201 *Fax*: (3) 230-3524
Telex: 22975

Det Norske Veritas
Veritasveien 1, PO Box 300
N-1322 Hovik, Oslo, Norway
Tel: (2) 47 99 00 *Fax*: (2) 47 99 11/12
Telex: 76192

Polish Register of Shipping
ul Waly Piastowskie 24
PL-80801 Gdansk 1, Poland
Tel: (58) 31 19 87 *Telex*: 512373

Registro Italiano Navale
Via Corsica 12
I-16128 Genoa, Italy
Tel: (10) 53851 *Telex*: 270022

USSR Register of Shipping
Dvortsovaya Nab 8
192041 Leningrad, USSR
Tel: 211 97 33 *Telex*: 121525

Part No.	Description
1 THRU 9	CROSS MEMBERS
10	FORKLIFT POCKETS
11	FLOOR
12	BOTTOM SIDE RAIL

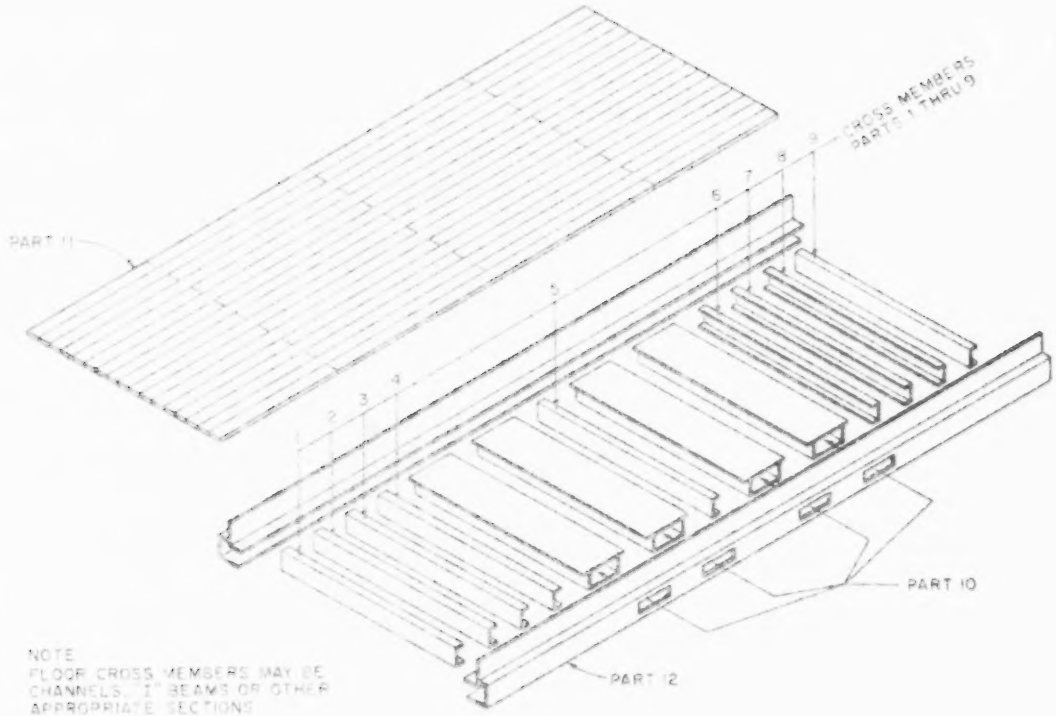
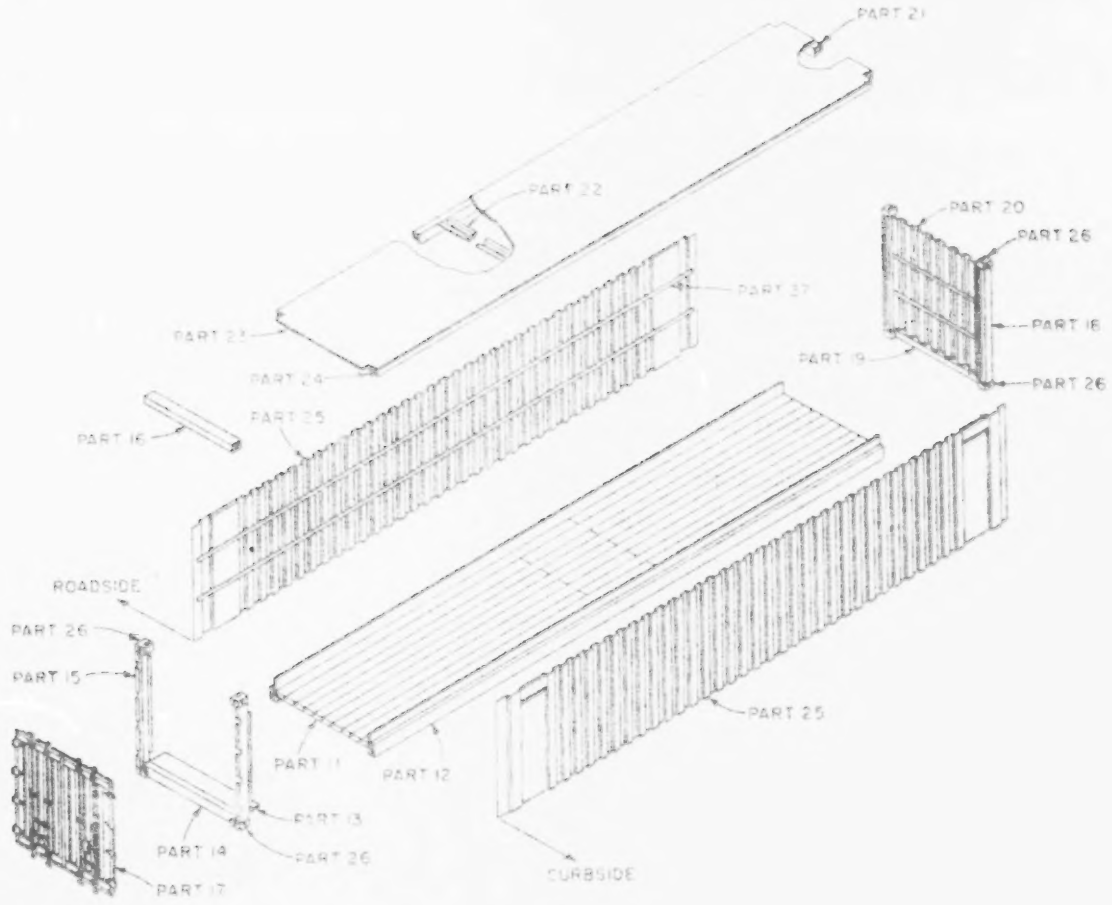


Fig. 3/Exploded diagram—base and flooring

Part No.	Description
11	FLOOR
12	BOTTOM SIDE RAIL
13	THRESHOLD PLATE
14	DOOR SILL
15 & 18	CORNER POSTS
16	DOOR HEADER
17	END DOOR
19	BOTTOM END RAIL



Part No.	Description
20	END WALL (PANEL)
21	TOP RAIL
22	ROOF BOW
23	ROOF SHEET
24	TOP RAIL
25	SIDE PANEL
26	CORNER FITTINGS
27	LASHING STRIP

Fig. 1 Exploded view of container – steel.

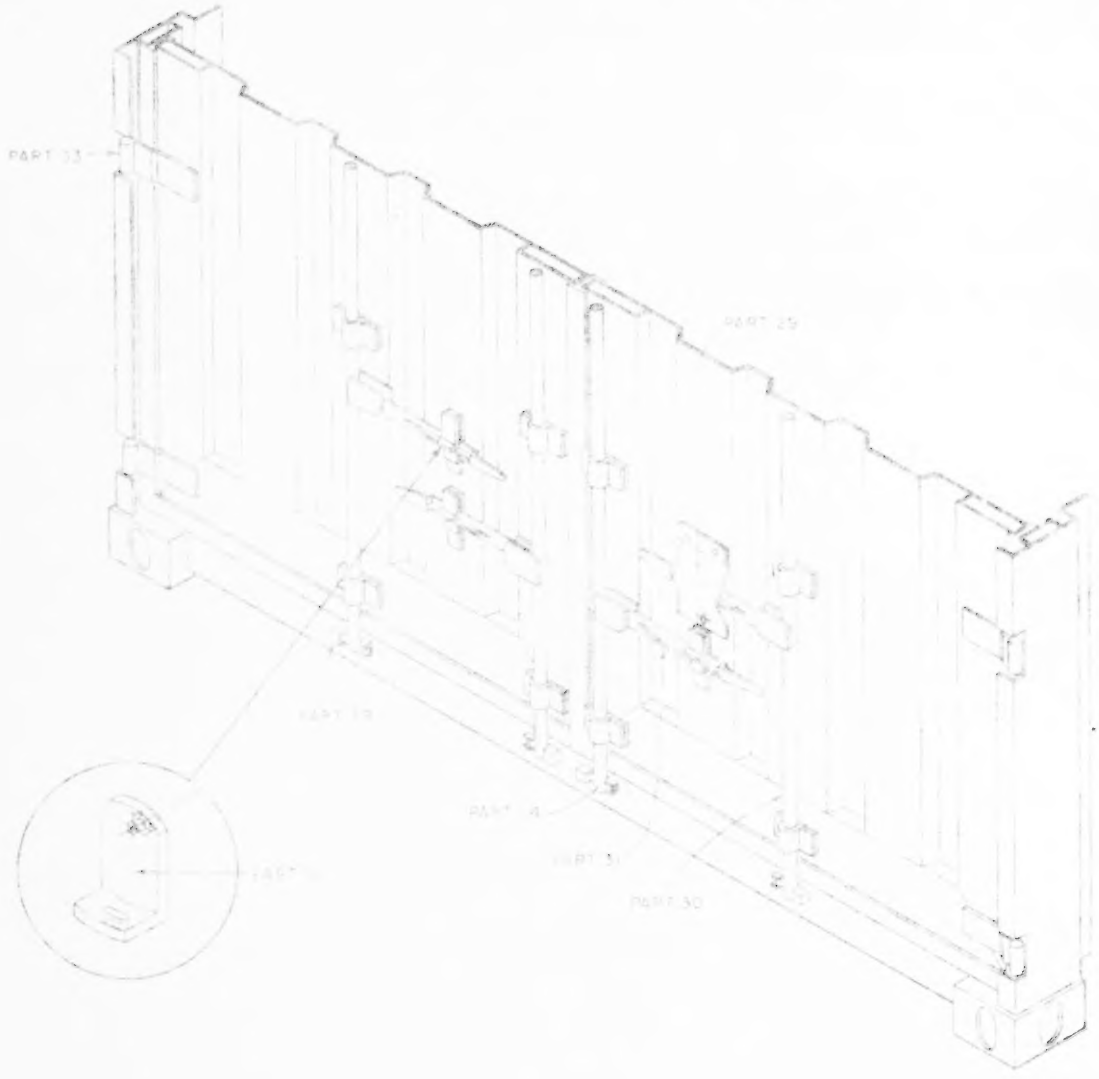


Fig. 4 Door customs flap and arm detail

Part No.	Description
18	CORNER POST
19	BOTTOM END RAIL
22	ROOF BOW
23	ROOF SHEET
24	TOP RAIL
25	SIDE PANEL
26	CORNER FITTING
27	SIDE POST

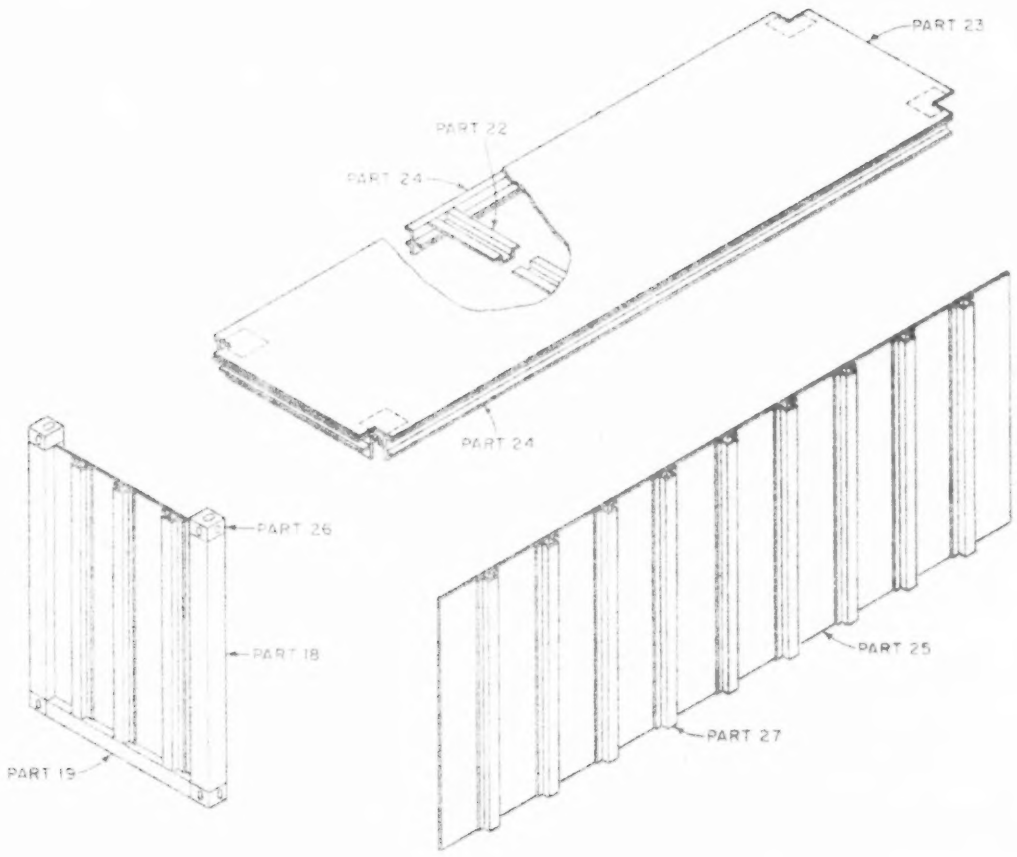
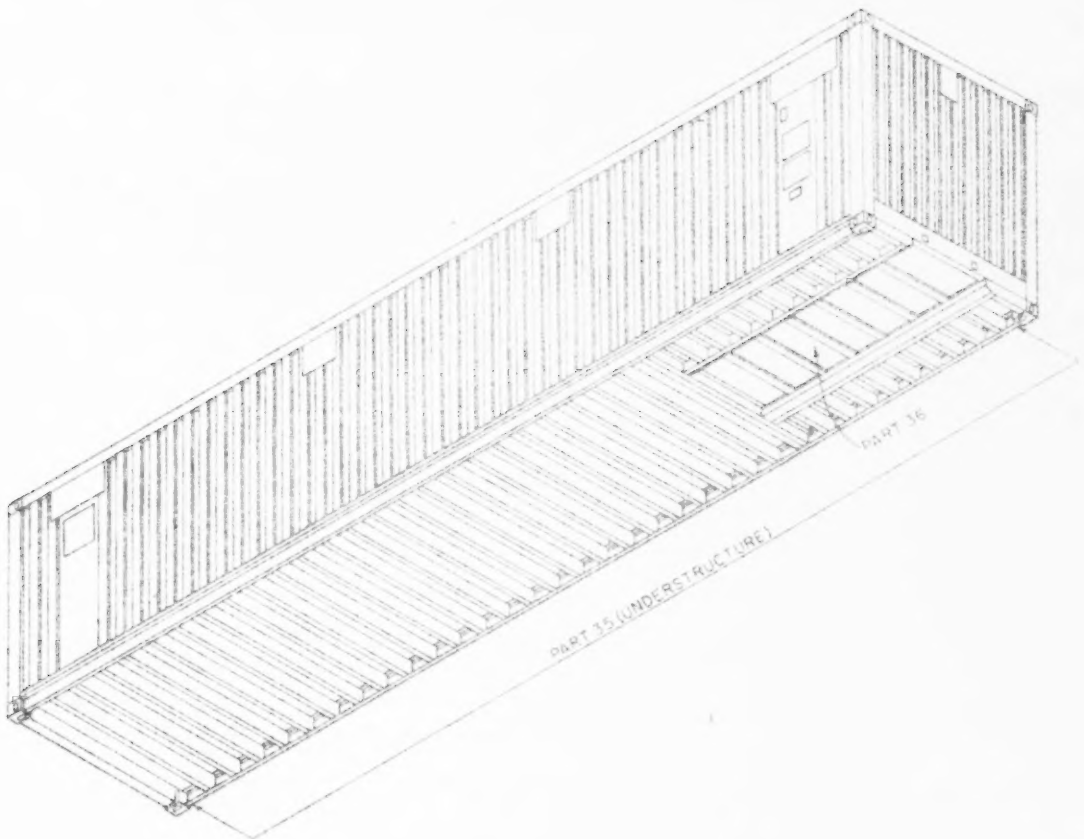


Fig. 2/Exploded part view of container–aluminum.

Part No.	Description
35	UNDERSTRUCTURE
36	TUNNEL



g. 6/Understructure and recess tunnel.

ANNEX 5

CONTAINER THROUGHPUT AT SELECTED AFRICAN PORTS*

Port		1980 Loaded	1980 Empty	1981 Loaded	1981 Empty	1982 Loaded	1982 Empty	1983 Loaded	1983 Empty	1984 Loaded	1984 Empty	1985 Loaded	1985 Empty	1986 Loaded	1986 Empty	SUB-TOTAL Loaded	SUB-TOTAL Empty	TOTAL TEU
Djibouti:	Import	-	-	7201	1536	5887	286	7195	160	7625	542	6089	115	-	-	34976	2639	37615
	Export	-	-	2798	2901	974	4815	1061	6863	1418	5940	1072	6288	-	-	7321	26003	33324
Assab:	Import	-	-	-	-	-	-	1206	89	1270	85	2695	290	-	-	5089	424	5113
	Export	-	-	-	-	-	-	332	596	254	1089	259	561	-	-	845	2566	3410
Mombasa:	Import	10605	5423	13354	9839	6624	11937	20803	22108	30942	37564	33788	16281	59004	19495	167180	135942	293122
	Export	11091	3541	16948	3609	12695	4753	34828	6317	17667	5994	44966	5327	48729	7004	196716	34845	231561
Tamatave:	Import	3355	2365	1581	1771	1662	4120	1501	3247	2453	3892	3067	2004	-	-	14619	36598	48917
	Export	1965	4264	2123	3813	1563	3776	1200	3375	1694	4736	1686	4078	-	-	10237	24040	34277
Port Louis:	Import	10267	151	10730	907	10701	857	11756	952	18301	1195	17400	104	13500(E)	0	82655	4056	87511
	Export	3309	6528	4595	7036	4957	6786	5102	7159	6110	7321	7075	8527	7000	7000	38041	48857	86898
Maputo:	Import	1771	645	2597	326	4138	107	4263	0	3601	0	4092	1	5088(E)	0	25952	989	26941
	Export	868	498	3391	516	6009	132	7127	11	4474	39	2032	4	714	0	25066	1200	26266
Port Victoria:	Import	-	-	1003	0	1234	25	1292	20	1366	30	1601	40	1750(E)	50	8291	165	8416
	Export	-	-	64	899	93	971	89	720	118	981	251	1358	300	1400	915	6329	7244
Port Sudan:	Import	57188	189	81403	191	-	-	10937	36	9751	671	8535	160	12168	738	179982	1931	181913
	Export	3519	7078	17409	7880	-	-	2040	6462	3330	5167	2603	5031	4591	6355	33492	37933	71425
Dar-es-Salaam:	Import	4740	-	8041	1733	13290	1776	12792	1849	17093	2369	23331	581	24200(E)	600	103467	8862	112349
	Export	2093	2443	4640	3600	8034	5196	7683	4958	10685	3644	13020	5679	15100	7200	59255	32722	91977
Oran:	Import	-	-	-	-	-	-	6745	0	7757	0	-	-	-	-	14503	0	14503
	Export	-	-	-	-	-	-	0	6486	0	7203	-	-	-	-	0	13689	13689
Alexandria:	Import	1384	-	58035	1051	55839	1011	75726	268	73490	186	68000	232	72760(E)	248	440214	2996	443210
	Export	927	-	10155	32331	10639	38489	16536	44713	27356	38715	14945	51160	15981	54741	128351	260149	388500
Port Said:	Import	-	-	19136	-	17865	-	22034	0	22363	0	20163	0	15440	0	116983	0	116983
	Export	-	-	18051	-	18746	-	406	18906	686	22776	853	21033	744	16360	20740	79075	99815

Casablanca:	Import	26066	2544	25087	957	29241	884	26810	1289	25686	1853	29400	2040(f)	-	-	162990	9667	172657
	Export	25367	2566	25037	1783	13745	16393	13984	13887	14469	14352	15770	15787	-	-	109173	64868	174041
La Goulette:	Import	-	-	-	-	-	-	8521	0	9255	0	15000	0	12000	0	44777	0	44777
	Export	-	-	-	-	-	-	900	8087	1000	9662	1500	6500	3000	4000	6400	27244	33644
Douala:	Import	[illegible]	-	24530	-	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible]	[illegible]	[illegible]
	Export	15867	-	20973	-	18601	-	10031	17137	21842	20648	20776	25185	-	-	115990	62966	178956
Tema:	Import	4292	-	7776	0	4286	0	8141	0	10098	0	10424	0	-	-	45017	0	45017
	Export	806	3096	1204	5479	1543	3958	1483	[illegible]	[illegible]	8474	1748	8937	-	-	[illegible]	[illegible]	[illegible]
Lagos-Apapa	Import	[illegible]	-	[illegible]	0	[illegible]	0	[illegible]	0	[illegible]	0	[illegible]	0	[illegible](E)	0	[illegible]	[illegible]	[illegible]
	Export	1620	89134	2265	108,825	5454	36208	[illegible]	55016	[illegible]	33677	3956	31301	5750	[illegible]	[illegible]	526131	[illegible]
Port Harcourt	Import	[illegible]	-	[illegible]	0	10087	0	[illegible]	0	[illegible]	2	[illegible]	15	6500(E)	50	58477	44	[illegible]
	Export	140	10116	260	20385	539	17151	811	7492	4048	3120	767	5254	4500	6500	11026	70018	81094
Freetown	Import	[illegible]	1027	5401	1384	[illegible]	0	[illegible]	721	[illegible]	127	3452	123	4800	327(E)	[illegible]	3703	[illegible]
	Export	1027	4100	[illegible]	3104	575	8476	478	3618	817	4611	601	4371	1108	5531	7590	34329	41919
Lome	Import	-	-	15812	0	16618	268	14607	698	17324	1099	20509	883	-	-	86009	2939	88028
	Export	-	-	0	15246	1967	14167	1852	[illegible]	[illegible]	[illegible]	4833	15559	-	-	[illegible]	[illegible]	[illegible]
Matadi	Import	-	-	11000	300	12600	120	13457	356	15041	2714	-	-	-	-	52096	2714	55588
	Export	-	-	7200	2030	8600	2700	10174	2557	10087	8045	-	-	-	-	36061	15331	51393
Abidjan	Import	51009	16711	59289	20764	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34009	46890	34601	343360	[illegible]	[illegible]
	Export	48380	16781	59973	22085	56189	22778	50685	20421	54602	19570	59644	22596	58735	19070	388228	143301	531529
Lobito:	Import	181	-	552	0	900	0	1098	1	2284	1	-	-	-	-	5015	2	5017
	Export	-	260	0	275	1	595	46	768	64	1102	-	-	-	-	111	3100	3211
Conakry	Import	-	-	-	-	-	-	2571	0	4520	0	5803	6	7000	120(E)	20494	126	5020
	Export	-	-	-	-	-	-	127	1997	147	2190	283	5538	400	6900	957	16225	17182

(E) Estimates
(f) Years 1980-82 includes empty containers

Compiled from Containerisation International Yearbook.

Annex VI

Operational Environment
(a) Physical plant*

While there are many factors that should be taken into account when planning the physical plant of a container repair and maintenance enterprise, some of the more important for this discussion are (i) the workshop, (ii) storage area and (iii) administrative offices.

Although European container repair facilities have fully enclosed workshops, in many Latin American facilities such as Lingas, Reparacion do Contendores and Politrans, the repair areas are only covered by a roof. The use of a roof for the workshop provides workers with a dry place to effect repairs during the rainy season, but at the same time reduces needed investment. As an example, Ligas began operations with only a small covered workshop, under which approximately eight containers might be repaired simultaneously. As the demand for repairs has grown, it is planned to double the covered workshop area.

While workshop floor areas for European and most Latin American repair facilities are of cement, LLOYDBRATI at Santos, Brazil, has utilized removable two metre square reinforced concrete "rafts" for its workshop floor. These concrete squares require only a levelled sandy base, can be installed in a minimum of time and may be reutilized at other locations. Their advantage is that they may be easily lifted by a fork-lift truck for rapid installation or removal to another location. Nonetheless, if they are exposed to the weather, joints must be carefully sealed or water will enter, permitting the "rafts" to rock and thereby pumping a mixture of sand and water to the surface..

As the covered area for the newly established enterprise will be relatively small, it is necessary to ensure that this area is not used for the storage of containers or spare parts. The covered repair area should be viewed as the most important revenue-gathering area and, therefore, utilized for the repair of damaged containers to its fullest extent.

In order to attract repair work from leasing companies, repairers must offer a sufficient container storage area. There are no mathematical formulas which will assist in determining the total area needed for a container repair and storage facility. The relevant factors which should be considered, however, are (i) the desired container stacking heights in relation to the cost of handling equipment and storage area surfacing, (ii) the average time during which the container will remain at the facility - both for repair and storage, (iii) the proportion of 40' and 20' containers at the facility, and (iv) the number of customers and their requirements. With reference to the latter, most leasing company depot agreements require storage space for a specific number of containers, such as 850 TEUs.

*Source: Establishing Container Repair and Maintenance Enterprises in Latin America and the Carribbean E/CEPAL/º.1243, May 1983.

While opinions vary as to what type of surface covering is needed for a container storage area, Mr. J. Evans of Geoffrey Reyner Container Repairs Ltd., at Manchester, United Kingdom, indicated that the land must be self-draining to protect wood floors and must have a gravel surface, thereby making it serviceable in all seasons. On the other hand, Dr. W. Grevarath of REMAIN at Hamburg, Germany, considered that a flat-cement type of surface for the storage area was necessary to reduce the costly wear and tear on container handling equipment such as fork-lift trucks. Another alternative which could be utilized to achieve surfacing economies would be placement of the aforementioned concrete "rafts" under container corner fittings. In this manner these "rafts" could be utilized to reduce pavement costs by providing pads for supporting container corners, with unsurfaced gravel between them.

The majority of new repair facilities utilize containers for office space, storage of spare parts and tools, and to provide sanitary and lunch room facilities for employees. For example, Politrans at Rio de Janeiro, Brazil, has utilized three TEUs and two TEUs in a stacked combination to create movable workshop and office areas on a leased site no more than 500 metres from the dock area.

In summary, the physical plant for a newly established container repair facility should include the following:

(i) a roof for the workshop area;
(ii) a cement floor for the workshop and adjacent handling area;
(iii) a gravel surface for the storage area; and
(iv) three to five modified containers for an office, spare parts and equipment storage, sanitary facilities, etc.

(b) Equipment and spare parts

While the newly established repair enterprise might greatly reduce its equipment needs by purchasing instead of fabricating spare parts, this would result in greater operating expenses which could, in a highly competitive situation make the facility less profitable or even unprofitable. Consequently, persons evaluating the feasibility of establishing a repair facility might wish to consider the acquisition of, of inter alia, the following:

(i) Argon, MIG and stick welding, and propane gas cutting equipment;
(ii) Electric drills, hacksaw and disc grinder;
(iii) Twenty-ton hydraulic jacks and steam cleaner;
(iv) Portable lights, extension cords, rivet guns, ladders;
(v) Air compressor and airlines;
(vi) Steel cutting shear and bending press;
(vii) Fork-lift truck with adjustable spreader for empty 20 and 40 foot ISO containers;
(viii) Circular saw for wood; and
(ix) Truck tractor and trailers.

As the steel bending press, cutting shear, fork-lift truck, truck tractor and trailers require large capital expenditures for their acquisition, most Latin American repair enterprises have avoided such expenditures by sub-contracting the transport of containers to and from the facility and the fabrication of spare parts to other metal working shops, and by renting appropriate fork-lift trucks. For example, Multimodal, at Buenos Aires, Argentina, began repair operations in 1970 and has not, as yet, found it necessary to purchase a steel bending press and cutting shear. Likewise, Reparacion do Contenedores, of Santos, Brazil, contracts the movement of containers through a local truck owners' association and rents two of its fork-lift trucks.

The availability of spare parts is a critical problem for repairers. Many spares are difficult to obtain, especially for old containers or containers manufactured in remote locations. Repairers are often forced to purchase and cannibalize scrapped containers for spare parts or to fabricate spares themselves. For lack of parts, repairs can be held up for long periods of time. This means lost revenue to the repairer's customers, and chronic parts problems can cause customers to change repairers. In an effort to avoid this situation, many repair facilities have acquired steel bending and cutting equipment for the fabrication of needed spare parts.

As a container repair organization could hardly be expected to carry spare parts for every conceivable type of container likely to pass through its facility, it may contract depot services for one or more container leasing companies and thus know what types of spare part to have available. While the repair industry has moved a long way towards becoming self-sufficient in the fabrication of container spare parts, it is still in many ways dependent on external sources of supply. This dependence is due to a number of factors, such as the insistence of container owners that damaged areas be repaired with specific types of components, and the proliferation of container types has somewhat reduced the feasibility of container repairers fabricating all needed component parts. It is, then, important for repairers to keep in close contact with sources of supply for various types of components, and in particular those sources which can offer a fast delivery service.

As a result, the newly established repair facility must determine the availability of needed supplies such as paints and steel plates in the national and international markets. If these suppliers are not available locally and can be imported at a reasonable price, the facility must then be assured that its sources of supply respond rapidly to requests, offer products of unvarying quality and utilize adequate packing for protection during transport.

(c) Personnel skills

The repair facility must have a trained workforce with a comprehensive range of skills. Moreover, repairers must provide continuity of service, which means a stable work force, administration and management capable of adapting quickly to varying workloads.

As seen by container repairers, container owners have four principal needs. First, a comprehensive range of container repair and maintenance services with the availability of additional services such as storage and transport. Second, flexibility of service. The types of service that owners need and expect are extensive and volumes vary considerably. The flexibility of services also includes other requirements such as personal contacts and repairs, if needed, outside normal working hours. Third, convenience of service. The requirements of container owners vary greatly but, as a general rule, repair facilities must be near their base of operations and sufficiently near the centres of freight movement. The reason is obvious - to reduce empty container transport costs. Finally, while most container owners have their own repair manuals, they need to be assured that repair work undertaken will be completed to desired standards. Further, one might add the overall requirements of repair work to be accomplished rapidly and at a reasonable price.

While skills needed by workers to repair dry cargo steel containers are many, some of the more important are experience with metalworking hand tools, bending and cutting sheet metal, gas, electric and inert gas welding system, and familiarity with the use of blueprints and wiring diagrams. Furthermore, repair workers are usually assisted by specialists such as an electrician to service appropriate systems for tools, trailers, fork-lift trucks, etc., a maintenance man to service mechanical tools, engines, etc., a man to issue, store and order needed spare parts, an inspector to review containers upon arrival for damage and complete equipment interchange and damage reports, a foreman to schedule, inspect and approve repair work, and a carpenter to replace damaged flooring. While these specialists might seem to create a heavy monetary demand on the enterprise, it should be understood that many of these functions may be combined and are often performed by the repairmen themselves.

Although a repair enterprise relies upon the services of many skilled workers, the estimator occupies a pivotal role in the overall functioning of such a facility. If the estimator bids too low for certain repair work the possibility of a reasonable return on invested capital will be reduced or even eliminated, and if his bids are too high the facility runs the risk of not receiving such work. As candidates for this important function, many repairers select fabricators and welders, who have a good working knowledge of containers, and place them with an experienced estimator for about three months. While at the end of this period the newly-trained estimators can begin to work alone, an active dialogue should be maintained with their experienced counterparts to resolve any doubts, thereby ensuring that bids are neither too high nor too low.

As the newly-established facility will not have a pool of experienced repairmen from which estimators might be selected, the enterprise may wish to investigate the feasibility of training its estimators at other facilities in the region. Nonetheless, Mr. H. Haight, General Manager of Societe Fosseenne d'Entretien de Conteinurs, Fos-sur-Mer, France, was of the opinion that an estimator could compare actual container damage with such standards to estimate the cost of repair work.

(d) Mobile repair units

In order to determine the circumstances under which mobile repair units would find their best application, it is necessary to evaluate the sources of container repair work and the way in which these sources normally seek repair services. The sources of container repair work are (a) leasing companies, (b) shipping lines, (c) port authorities, (d) interior cargo terminals (ICT), (e) major exporters and (f) freight forwarders. While leasing companies and shipping lines usually seek repair services from designated depots, ICTs, major exporters and freight forwarders could utilize mobile services at their facilities, as they may damage containers during stuffing or stripping operations. However, for countries which have not as yet established ICTs and where major exporters and freight forwarders do not make wide use of containers, the demand for mobile repair services would probably be limited to on-dock repair services (if such units are permitted in the port area).

When a sealed container is damaged during port handling operations, consideration should be given to whether the journey might be continued by effecting such repairs as will suffice to protect the contents until they reach their destination. It should be understood that having a container unsealed by the appropriate governmental authorities means delay, increased cargo handling costs, and the possibility of breakage and pilferage. Therefore, where containers are damaged during transit or transshipment operations - for example, between Salina Cruz and Coatzacoalcos, Mexico and Jamaica - temporary repairs should be effected at such locations for protection of the cargo and to permit the on-carriage to be completed.

A mobile repair service must be prepared to operate on board ship, at dockside, and at depots. As some locations may have restrictions on welding, alternative means for effecting needed repairs must be available. According to Mr. R. Game of Overseas Containers Limited, 80 per cent of their container repairs - 50 per cent by value - are effected by mobile units. It is interesting to note that such units permit the elimination of the transport and lifting costs involved in the transfer of containers to stationary facilities for all repairs other than major structural damage. Nonetheless, Dr. W. Greverath of REMAIN at Hamburg, Germany, indicated that mobile units lose their cost-effectiveness unless backed-up by a stationary facility with appropriate equipment for the fabrication of spare parts.

To profitably employ a mobile repair unit, the enterprise should be assured of enough work, such as a minimum of one at each repair location. This means that mobile units do not provide emergency repair services but planned services to meet consistent demands. An emergency service can be, and often is provided, but such services should b costed on a different basis. The work carried out by mobile units on containers has three main limiting factors.

(a) the lack of equipment to effect major structural repairs;
(b) the need for a control system which assures the same repair quality as for those effected at stationary facilities; and

(c) the need for special cost and time control systems, as mobile unit repair personnel function away from the stationary facility.

As a result, the person in charge of a mobile repair service must not only be a reliable technician but must also be able to work independently, have a good understanding of port and depot working requirements, and have a capacity to schedule work.

There are two principal types of mobile repair unit: (i) a motor vehicle with a van body equipped as a workshop and (ii) a container similarly equipped, which can be transported on a trailer.

(e) Specific operational aspects

As was stated in the preface, this book does not purport to be a manual of methods by which containers might be repaired. Nonetheless, during the collection of information from container repair facilities and their major customers as well as supplies of spare parts and paints, certain working features came to light which those persons considering the establishment of such facilities might wish to evaluate. Of the many features encountered, some of the more important include (i) the nature of the container repairs, (ii) container inspection (iii) documentation, (iv) surface preparation and painting, (v) container markings, (vi) workers' productivity programmes, and (vii) cost control and profitability.

(i) The nature of the container repairs.

As repair work on a particular container depends on the damage, the type of container, its construction material, standards of repair and the customer, each task must be tailored to fit the situation. Due to the unique nature of each repair and the consequent need for flexibility, repair work is very labour-intensive. Moreover, the work force must be moderately skilled and versatile. While some mechanization is possible with the use of hydraulic rams for straightening, automatic welding and painting and some jigs and fixtures, it must be understood that these devices are merely used as aids to an otherwise manual operation. Automation or assembly line techniques have little application in container repair. Only rarely will a task be repeated in exactly the same manner more than a few times. The design, construction, and condition of containers vary so much that jigs, fixtures, and special tools cannot be utilized to achieve assembly line repairs. Even containers of the same design and from the same manufacturers become unique after repeated damage and repair.

(ii) Container inspection

While container inspection involves an extensive range of human judgement and other factors such as varying commercial attitudes, the importance of careful container inspections cannot be too strongly emphasized. The inspection, repair and storage needs of the container leasing industry differ

from those of other container owners in that careful inspection and repair serve important commercial purposes. In fact, the interests of both the leasing industry and its customers require competent container inspections and repair. The industry recognizes two distinct situations in which responsibility for the condition of containers shifts between lessors and lessees. Until containers are accepted by lessees, lessors are, of course, responsible for all damage. If a container is not in proper condition on delivery, the lessee may reject it; if it is not in proper condition on return, the lease agreement provides that the lessee is financially responsible for repair costs. As a result, once containers are accepted by lessees they become responsible for all damage. Thus, the delivery of containers by lessors to lessees and redelivery to lessors are the recognized acts which shift legal responsibility for container damage.

Due to the worldwide nature of container leasing, it should be understood that repair enterprises, in carrying out container inspections, play a major role in determining responsibility for container damage. As lessors cannot themselves receive from and deliver to lessees their many thousands of containers, they have executed depot/storage agreements with repair enterprises for that purpose. In this situation, lessors must rely upon the inspections carried out by such enterprises with, of course, occasional checks by their own surveyors. The primary problem with the inspection of leased containers appears to lie not so much in failure to inspect such equipment as in the fundamental determination of when the damage occurred, thereby placing responsibility for its repair.

In order to assist with the execution of inspections, the IICL has prepared and published a Guide for Container Equipment Inspection which is applicable to both the leasing industry and its customers - the same inspection criteria apply for containers delivered to and returned by lessees. While lessees are encouraged by leasing companies to conduct on-hire inspections to assure that containers received are in an undamaged condition, many repair facilities have indicated that off-hire inspections outnumber those for the on-hire situation 50 to 1. Moreover, off-hire inspections often involve negotiations between lessees and lessors with regard to the cost of repair, who is responsible, what is permissible "wear and tear", container repositioning costs, and those locations at which containers are regarded as off-hire.

All major leasing companies maintain a worldwide network of surveyors to verify damage estimates and approve repairs. While the management of many repair facilities indicated that these surveyors provide useful technical advice concerning various methods by which damaged containers can be repaired, others considered their technical ability to be too limited to permit them to do more than verify the existence of damage and its subsequent repair. Nonetheless, newly established repair enterprises should make every effort to utilize the experience and technical skills of such surveyors.

While most leasing companies have their own inspectors for the review of repaired containers, the most important are those employed by the enterprise itself, since these inspectors normally determine what is to be done and the resulting quality of repairs before the leasing company inspectors have a chance to review the work.

At most containers are inspected at the inbound or outbound stage of transport operations, maintenance and repair of an individual container is an ongoing, continuous process. Regular inspection with a view to preventive maintenance and repair is essential, bearing in mind the financial implications of the extremes of container maintenance and repair versus replacement policies.

(iii) Documentation

The documentary aspects of container inspection, damage estimation, repair costing and administrative control, which make possible a frequent and accurate flow of information to customers, must be a priority concern of those enterprises which seek to provide repair services to leasing companies and many shipping lines. The documentation utilized by a repair facility is normally composed of the following elements:

Container receipt:
- telex or telephone message from owner to depot requesting acceptance of container;
- gatehouse receipt signed by driver delivering container, container number recorded in overall master book and given job number;

Container inspection:
-equipment interchange receipt (EIR) completed and sent to appropriate leasing company;
- estimate of repair (EOR) completed for all damaged containers and sent to owner or lessee depending on who under the terms of the lease is responsible for damages. In all cases an informational copy of the estimate is sent to the lessor;

Container repairs:
- telex from container owner authorizing repairs;
- copy of EOR
-individual container work card for hours and materials used;
- T-cards for the job control board;
- repairmen's time sheets, and;
- repair materials requisitions;

Container billing:
- invoice for billing

When a container arrives at the repair facility it should be checked for receipt against an "acceptance list". This list contains the numbers of the containers that each customer has requested the facility to receive. Thereafter an "acceptance note" is prepared and signed by the person delivering the container - usually the driver of a truck. The container is then unloaded and thoroughly inspected for damage. If undamaged, the container is placed in storage; if damaged, it should be placed in an "awaiting repair" location near the shop. In both situations the storage charges should start immediately after the inspection is completed.

The "acceptance note" is delivered to the repair facility office and the information contained thereon is transferred to the appropriate customer's equipment interchange receipt (EIR). The EIR is sent to the customer with, if the container is damaged, an estimate of repair (EOR) requesting authorization to commence repair work. Also, the container number and date received are entered in chronological order in a "master book". A "T-card" is then prepared with the customer's name and container number, and placed on the control board under "awaiting repair authorization".

In order to effectively programme the overall flow of work, most repairers utilize a job control board on which individual container T-cards are placed under the following appropriate headings:

1. awaiting inspection
2. awaiting repair authorization
3. repair authorization received
4. under repair
5. under refurbishment
6. completed and transferred to storage

When authorization for repair is received, the details are entered in the "master book" and on the container control T-card. The authorized repair work can now commence and a "work card" is given to the repair crew. This card shows the repair work to be undertaken and the maximum hours allowed. Furthermore, time sheets and material requisitions are prepared to ensure correct costing and pricing for repair services rendered.

Upon completion of repair work the "work card" is returned to the facility office and dated. This date is also entered in the "master book". The customer is then notified that the container has been repaired and the date of notification is entered in the "master book". Finally, the container is placed in storage and the last entry in the "master book" occurs when the container leaves the facility.

The repair facility normally provides a daily repair completion report and weekly status report to its customers. In order to provide this information repair facilities must have ready access to telex and telephone services.

(iv) Surface preparation and painting

Modern marine paint technology is a very specialized field largely created by the introduction, in the late 1950s, of large oil tankers, followed a few years later by sophisticated container ships. As a result of the high capital investment involved, there was a pressing need at that time for improved protection against corrosion and fouling in order to ensure that such vessels were kept at sea for longer periods. It should be understood that the first containers introduced in marine service were little more than standard highway trailers without chassis or wheels. As these trailers lacked surface preparation for the marine environment, steel members corroded rapidly.

During the last 30 years tremendous advances have been made in protective coating technology. These developments have brought about the availability of coating systems which, either by themselves or in combination with others, have potential service life expectancies of five, ten and even fifteen years - often under harsh environmental conditions.

Despite the availability of these materials, however, the common experience is, that coating systems fail prematurely in service. In cases of premature coating failure the cause can seldom be attributed to the material employed. Almost invariably premature coating failure is due to inadequate regard for surface preparation and, somewhat less frequently, to poor workmanship in the application of a coating system, or to the application being carried out under adverse environmental conditions. It is now widely understood that the achievement of 100 per cent coating system efficiency will depend 65 per cent on surface preparation, 25 per cent on quality of application - such as adequate coating thicknesses at sharp edges and angles, freedom from voids and misses in the coating, etc. - and only 10 per cent on the actual coating material.

In repair or minor maintenance situations other factors come into play to exert an influence over the success of a coating. Particularly notable is the fact that a coating used in this situation must be compatible with the original coating. The surface preparation and painting of repairs may be accomplished with an electric wire brush and disc sander, and the appropriate paint may be applied with a hand brush. Only when a repair facility also offers refurbishment of containers does it become necessary to utilize shot blasting for surface preparation and spray equipment for painting.

Many different types of coating are used to protect containers from corrosion. While two coats are normally applied, a primer and a top coat, single-coat systems have given good results in some tests. Usually container owners select the paint system desired. The majority of paint companies such as Hempel's Marine Paints and Mander-Domolac provide free technical assistance to assure that their paint systems are correctly applied. Furthermore, many paint companies have prepared engineering drawings and other specifications for container construction and refurbishment plants which persons desiring to establish such facilities might be allowed to use, provided that these companies' products are utilized preferentially.

(v) Container markings

Container owners mark their units to satisfy various legal requirements as well as for advertising purposes. To accomplish these purposes owners usually employ vinyl markings. There are two types of vinyl marking - cast and calendered. The former is produced in a liquified form and allowed to flow in a mould. Calendered markings, on the other hand, are produced by rolling a plastic material out until the desired thickness is obtained. Cast vinyl will not shrink after it has been applied to the container. However, calendered markings will sometimes shrink and curl. Most manufacturers indicate that their products will last from five to seven years.

The application of container markings requires the indicated area to be free of oils, greases and silicones, the proper temperature, and a knowledge of the manufacturer's installation techniques. If a decal fails to stick, it is not usually because the product is unsatisfactory but rather because of improper surface preparation or the fact that the container is too cold or wet. Furthermore, a skilled applier may not have been available for the job. It should be understood that the need for a skilled applier is paramount, not simply because such a person can work faster, but because there will be less wastage. For example, an experienced applier might utilize a soap solution which permits markings to be slid into the proper position, after which the solution is pressed out.

(vi) Worker productivity programmes

While it might appear that each repair enterprise is at liberty to determine the hours and materials needed to effect repairs, such is not the case. Within the container repair industry there are maximum allowable hours and repair standards which determine the materials needed for each type of repair. As repair enterprises in this situation can control their costs only through worker productivity, a few repairers have instituted programmes whereby employees are given a bonus for effecting repairs in less than the standard time. For example, Geoffrey Reyner (Container Repairs) Ltd. at Manchester, United Kingdom, employs a productivity programme in which "the total time for repair" of containers forms the basis. This factor is obtained by adding the individual times for repairs on a container. When the leasing company authorizes a certain container to be repaired, a copy of the "total time for repair" - without times for individual elements - is given to the workshop. Each week a ratio is produced which compares the "total time for repair" of all workers directly involved in repair work with their total attendance hours. This ratio is then expressed as shop performance:

$$\frac{\text{Total time for repair}}{\text{Attendance hours}} \times 100 = \text{shop performance}$$

The management of Geoffrey Reyner Ltd. has found that, depending on the performance reached by the repair shop as a whole, this can result in the individual repair workers being paid an enhanced hourly rate which may, for an exceptional performance, double their earnings.

Of course, this productivity plan might be modified somewhat to include a quality control factor. In this situation the total time for repairs would be reduced by the time needed to rework any container. Thus, the repair workers should have an incentive not only to be productive but also to ensure that their work fully complies with industry standards.

$$\frac{\text{Total time for repair-time needed for rework (if any)}}{\text{Attendance hours}} \times 100 = \text{shop performance}$$

(vii) Cost control and profitability

As container repair and maintenance facilities have only four sources of income - from inspection, repair, storage and transport of containers - each of these sources should be maximized to assure the greatest overall profitability. While many customers will request free storage days for their containers, this request should be granted only when it is determined that such free days would make a greater contribution to profitability than storage income. Another factor to be taken into consideration is that many repair facilities offer substantial container storage space in order to protect themselves from the worst effects of varying repair volumes. For example, the management of Seashops at Colon, Panama, has found that when repair income has fallen, storage income as well as that from the repair of trailers has permitted the facility to remain profitable.

Although container lessors and shipping lines normally provide transport for a damaged unit to the selected repair facility, such facilities are often asked to transport containers for the performance of repairs or storage. For example, Geoffrey Reyner (Container Repairs) Ltd., REMAIN and REPCON all have appropriate container transport equipment, with the latter charging US$2,50/mile for this service.

In addition maximizing the income from each of the above sources, it should be understood that the profitability of a repair facility can be enhanced and is often determined by effective cost control. Some of the measures which can be taken to control repair facility costs include:

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1. Constant re-examination of container repair operations to determine where the use of jigs, fixtures and pre-fabrication of container sections would reduce repair times;
2. Minimizing the number of containers which must be returned to the workshop for "touch-up work;
3. Keeping in touch with repairmen to determine repair "bottlenecks" and methods by which they might be reduced or eliminated;
4. Minimizing the number of times a container must be moved within the repair facility; and
5. Minimizing the administrative overhead - secretaries, accountants, messengers and management personnel.